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Identification and Collection Of Historical Data Sets for: Buzzards Bay

Battelle
Ocean Sciences and Technology Department
Duxbury, MA 02332

BBP-88-06

The Buzzards Bay Project is sponsored by The US Environmental Protection Agency and The Massachusetts Executive Office of Environmental Affairs

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Final Report

on

IDENTIFICATION AND COLLECTION OF HISTORICAL DATA FOR BUZZARDS BAY, MASSACHUSETTS

VOLUME I

to

U.S. ENVIRONMENTAL PROTECTION AGENCY

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Work Assignment 23 - Task A

by

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FOREWORD

In 1984, Buzzards Bay was one of four estuaries in the country chosen to be part of the National Estuary Program. The Buzzards Bay Project was initiated in 1985 to protect water quality and the health of living resources in the bay by identifying resource management problems, investigating the causes of these problems, and recommending actions that will protect valuable resources from further environmental degradation. This multi-year project, jointly managed by United States Environmental Protection Agency and the Massachusetts Executive Office of Environmental Affairs, utilizes the efforts of local, state, and federal agencies, the academic community and local interest groups in developing a Master Plan that will ensure an acceptable and sustainable level of environmental quality for Buzzards Bay.

The Buzzards Bay Project is focusing on three priority problems: closure of shellfish beds, contamination of fish and shellfish by toxic metals and organic compounds, and high nutrient input and the potential pollutant effects. By early 1990, the Buzzards Bay Project will develop a Comprehensive Conservation and Management Plan to address the Project's overall objectives: to develop recommendations for regional water quality management that are based on sound information, to define the regulatory and management structure necessary to implement the recommendations, and to educate and involve the public in formulating and implementing these recommendations.

The Buzzards Bay Project has funded a variety of tasks that are intended to improve our understanding of the input, fate and effects of contaminants in coastal waters. The Project will identify and evaluate historic information as well as generate new data to fill information gaps. The results of these Project tasks are published in this Technical Series on Buzzards Bay.

This report represents the technical results of an investigation funded by the Buzzards Bay Project. The results and conclusions contained herein are those of the author(s). These conclusions have been reviewed by competent outside reviewers and found to be reasonable and legitimate based on the available data. The Management Committee of the Buzzards Bay Project accepts this report as technically sound and complete. The conclusions do not necessarily represent the recommendations of the Buzzards Bay Project. Final recommendations for resource management actions will be based upon the results of this and other investigations.

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INTRODUCTION

The Buzzards Bay Project, managed by EPA Region I, is focused on Buzzards Bay, which is located in southeastern Massachusetts and west of Cape Cod and runs along an approximate northeast to southwest axis (Figure 1). The Bay is approximately 30 miles long and 10 miles wide, and is made up of numerous narrow embayments and a wider main axis. Its northeastern end is connected to Cape Cod Bay by the Cape Cod Canal, a major artery for commercial cargo. The mouth of the Bay opens onto the continental shelf east of Rhode Island Sound. Buzzards Bay is an important economic and aesthetic resource to the communities that surround it and to the wider Massachusetts population. In addition to serving as a major cargo route, Buzzards Bay includes New Bedford Harbor, one of the most important fishing ports in the United States. Aesthetic resources in the Bay include boating, beaches, hunting, and fishing.

A top priority in the Bays Program, as the National Estuaries Program is usually called, is to characterize the status and health of selected estuaries and ascertain the trends and directions in their health. Such characterization requires examination of research already conducted in each estuary.

This study is designed to assist with preliminary characterization of Buzzards Bay and is divided into two major tasks. The first task is to identify and collect historical data sets for three topics concerning Buzzards Bay: lobster landings, water quality and nutrients, and toxic substances in organisms and sediments. Ongoing and completed research is identified for all three topics. The second task is to summarize the literature available on the three topics and to identify gaps in data for these areas.

This report presents results from the first task, the objectives of which are as follows:

1. Identification and collection of historical data sets on the three topics: lobster landings, water quality and nutrients, and toxic substances in organisms and sediments.

2. Development of screening criteria for evaluation of data sets.

3. Evaluation and establishment of priorities of data sets identified.

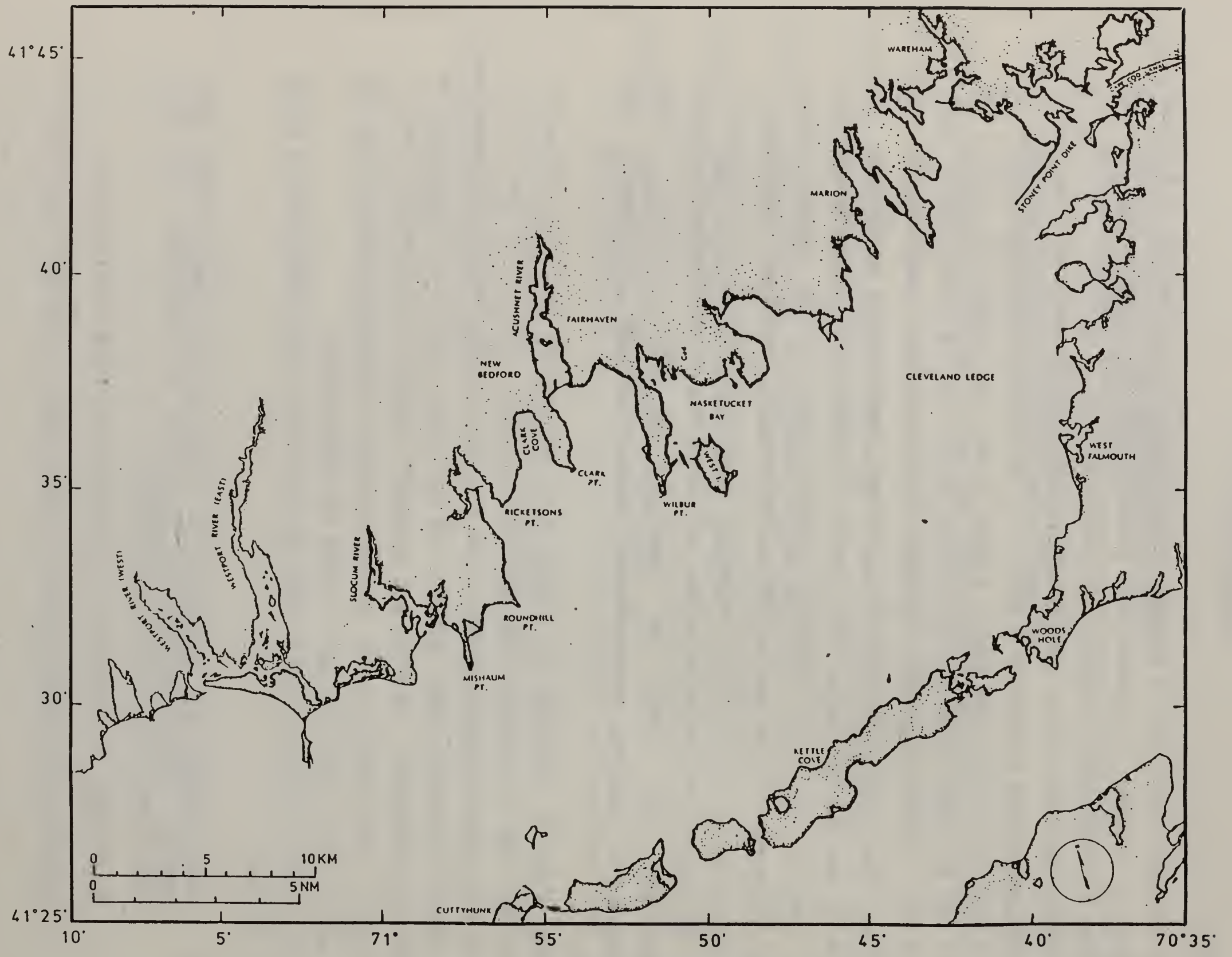

Figure 1. Map of Buzzards Bay.

4. Identification of high priority data sets suitable for entry into the EPA database management system.

5. Preliminary formatting of high priority data sets, where possible.

IDENTIFICATION AND COLLECTION OF DATA SETS

The procedure for identifying potential sets involved three steps:

1. Compiling, from the following sources, a list of persons to telephone:

   a. The Buzzards Bay bibliography produced by Bruce Tripp (Massachusetts Executive Office of Environmental Affairs).

   b. Names provided by Wendy Wiltse (EPA) and Bruce Tripp.

   c. Names provided by Battelle personnel.

2. Conducting telephone interviews to identify research that has been or is being carried out on the topics (lobster landings, water quality and nutrients, and toxic substances in organisms and sediments). A record in the form of a "Buzzards Bay Information Sheet" was kept for every person contacted. In some cases, the investigators were asked to complete the Information Sheet themselves. The Information Sheet is a standardized form designed to facilitate creation of a database of available information. The categories have been coded in many parts of the Information Sheet and codes are explained in the "Guidelines for the Buzzards Bay Information Sheet." Samples of both the Information Sheet and the Guidelines are presented in Appendix I.

3. During each telephone conversation, the investigator being interviewed was asked for names of other possible contacts and sources of data sets. It was possible to track the progress of the project by comparing the number of contacts made relative to the number of new leads identified. Initially, there were many new leads; now the number has dwindled to zero. New leads identified later in the project tended to be less productive in terms of new information than those identified earlier in the project. The later leads often led to investigators and data sets that had already been identified.

A total of 116 interviews were conducted. Appendix II contains a list of persons contacted and Appendix IV contains the Buzzards Bay Information Sheet completed for each of those contacts.

Data sets were collected either by requesting them over the telephone or by making site visits.

EVALUATION AND SETTING PRIORITIES OF DATA SETS

SCREENING CRITERIA

Methods

A set of screening criteria was developed to evaluate data sets and identify those with a high priority. The term "priority" is meant to imply utility in terms of the needs of the Buzzards Bay Project. "High priority" data sets are those that have the highest immediate utility, while "low priority" data sets have less immediate utility. Many of the "low priority" data sets contain excellent, high quality information and may have use in the project at a future date.

The screening criteria are general enough to apply to different types of data sets covering a variety of topics, so that they may be used by investigators at other institutions. These criteria were sent to Ms. Meryl Alber of the Boston University Marine Program and to Drs. Sandy Moss and James Hoff of Southeastern Massachusetts University to assist them with their evaluation of historical data sets for shellfish and finfish landings, respectively. The screening criteria cover critical aspects of and proved useful in the evaluation process.

The approach used to develop the screening criteria was to establish a series of screening filters. The first step was to review the data sets to ensure that the sets included were useful as a whole and relevant to the National Estuaries Program. After the preliminary review, a series of screening filters were applied sequentially to eliminate low priority data sets. Records were kept of the sets eliminated through this process. After each filter had been applied, a final review was conducted to ensure that important data sets providing unusual or useful data had not been eliminated.

At first glance, the approach described above may appear more subjective than a numerical ranking of data sets. However, either approach ultimately involves decision making on the part of the person doing the screening, either in applying the filters or assigning ranks. In both cases, the success or failure of the evaluation depends most on the expertise of the personnel evaluating the data sets.

The following filters were applied:

1. Coverage. Both spatial and temporal coverage were considered. Data sets covering only one or a few locations in Buzzards Bay were eliminated, while those with a broad distribution were included. Data sets representing only one point in time were eliminated; those with good temporal coverage were included.

2. Project Design. Several aspects of project design were considered in filtering data sets. Project designs that used standardized methods, developed an appropriate sampling design, employed state-of-the-art techniques, provided continuity throughout the project, and analyzed and reported the data accurately were considered acceptable; while those not meeting, or only partially meeting, the above criteria were eliminated.

3. Quality Assurance/Quality Control (QA/QC). Data sets subjected to quality control and/or quality assurance were included; those not using QA/QC procedures were excluded. What constituted QA/QC was left to the interpretation of the contacts; only the presence or absence of a formal, written QA/QC program was evaluated. (See comments below on criterion.)

4. Availability. Data sets that were inaccessible or difficult to retrieve were eliminated. Further, data that were in raw form too disorganized for practical use were eliminated.

Records were kept of all data sets under consideration throughout the evaluation process and of the reasons for elimination of any data sets from consideration as high priority data sets. The final step in the evaluation process was a review of the eliminated data sets to verify that no valuable data sets had been overlooked or unwittingly eliminated.

Comments on the Screening Criteria

The criteria developed for evaluation of data sets were designed before obtaining the data. With one exception, the criteria were found to be very useful. If the filters alone had been used for evaluating data sets, without the preliminary and final reviews, almost all of the data sets would have been eliminated because of lack of quality assurance (QA) or quality control (QC). In most cases, no formal QA/QC programs had been instituted. While chemical analyses usually included some degree of QC, its form was not always clearly specified. Quality assurance programs were notably lacking. Consequently, several data sets were included as high priority despite weak or lacking QA/QC.

Several very good data sets were eliminated from the high priority category due to lack of immediate availability. In some cases, the data sets may never be retrievable, while in others they might be retrievable with considerable effort. Low priority data sets that become available might be reclassified as high priority at a future date.

It should be noted here that the responsibility for deciding which data sets to use ultimately rests with the Technical Advisory Committee (TAC) for the Buzzards Bay Project. The prioritization of data sets contained here is designed to assist the TAC in making decisions about use of the data sets.

Results of the screening process are presented below. High priority data sets are discussed in detail. Low priority data sets and the reasons for their elimination are discussed briefly in Appendix III. Additional information on each data set may be found in the Buzzards Bay Information Sheets in Appendix IV.

OVERVIEW OF THE DATA SETS

With the resources available for this project, it was impossible to identify absolutely all data sets generated for the topic areas in Buzzards Bay. With guidance from EPA, we pursued those data sets that would best characterize the Bay for the topic areas and we believe we have identified the major or most pertinent studies for the Bay. A total of 52 data sets related to the major topics were identified. Of these, 15 were considered high priority data sets: one set for lobster landings, four sets for water quality and nutrients, and ten for toxic substances in organisms and sediments. The primary reasons for eliminating data sets from the high priority group were 1) the data were unavailable or 2) the data had limited temporal and/or spatial coverage. Several data sets that were unavailable could and should be retrieved and if they are, should be classified as high priority. These data sets are discussed in the section on low priority data sets. Most data sets did not include a formal, written quality assurance/quality control program.

HIGH PRIORITY DATA SETS

Lobster Landings

Introduction

The Massachusetts Coastal Lobster Fishery Statistics constitute the only existing data set for the topic of lobster landings. These statistics are published annually by the Massachusetts Division of Marine Fisheries.

Massachusetts Coastal Lobster Fishery Statistics	Mr. Charles Anderson Division of Marine Fisheries Mass. Department of Fisheries, Wildlife, and Recreational Vehicles Salem, MA

Description of the Data Set

Since 1967, the Massachusetts Division of Marine Fisheries (DMF) has published annual reports summarizing individual catch reports submitted by licensed lobster fishermen. Originally, the data were used for descriptive and informational purposes. Since the passage of the 1976 Fisheries Management Conservation Act, however, the annual catch data have provided the New England and Mid-Atlantic Fisheries Management Councils a statistical database for the development of a management plan for the entire east coast lobster fishery.

Data on lobster landings by each licensed lobsterman are collected as part of the yearly license renewal process. To renew a license, a lobsterman is required to provide catch data to the DMF. Fishermen not requesting license renewal also are legally obliged to complete catch reports.

Summary data reported annually by the DMF are based on catch reports actually submitted (during the period 1967-1973, the reporting rate ranged from 85 to 96 percent) and are not extrapolated to the 100 percent level. Summary statistics are reported by county where the lobsters were landed.

Evaluation of the Data Set Based on the Screening Criteria

The DMF lobster fishery statistics clearly met the initial screening criteria of usefulness and relevance to the Buzzards Bay Project in that the commercial lobster fishery is the most economically important fishery conducted within the territorial waters of the Commonwealth (1984 Massachusetts Lobster Fishery Statistics). This data set is especially important because it constitutes the only available data on lobster landings.

Sequential filters applied to the data set identified some significant problems with the data in terms of its value to the Buzzards Bay Project. The results of the evaluation based on the sequential filters are discussed below.

Coverage. Temporal coverage provided by the lobster statistics is good in that annual data are available from 1967 through the present. The program is ongoing and new summary data are available at yearly intervals. However, changes in categories of data collected (see section on Project Design) over time have diminished the value of the temporal coverage of the data set.

The annual lobster statistics include landings in all coastal Massachusetts counties, the statistics being reported on both a statewide and county-by-county basis. For the purposes of this study, the organization of the data by county presents problems in terms of spatial coverage. Three of the four counties that border Buzzards Bay also border other water bodies. Barnstable County borders Buzzards Bay, Cape Cod Bay, and Nantucket Sound; Plymouth County borders Buzzards Bay and Cape Cod Bay; and Dukes County borders Buzzards Bay and Nantucket Sound. Only Bristol County borders exclusively on Buzzards Bay. Therefore, it is impossible to know exactly what percentage of the lobsters landed in Barnstable, Plymouth, and Dukes Counties are landed along the shores of Buzzards Bay. To characterize lobster landings in Buzzards Bay alone would require estimating those percentages.

Beginning in 1979, the annual lobster fishery reports included tables that summarize pounds of lobsters landed by each city or town. By knowing the counties to which these cities or town belonged, we have roughly estimated the percentage of each county's lobster landings that are landed in Buzzards Bay.

Bristol County	100%
Plymouth County	<10%
Barnstable County	< 3%

The Dukes County percentages are unclear because towns listed in the tables do not include any towns on the Elizabeth Islands. The above figures must, therefore, be viewed as best guesses, and the lack of spatial specificity of the lobster landings data as a significant weakness of the data set within the context of the Buzzards Bay Project.

In addition, it should be noted that the lobster landings statistics do not provide specific information on the number or weight of lobsters caught inside versus outside Buzzards Bay. To our knowledge, such information is not available.

The landings data reflect lobsters landed at a particular township and do not indicate the specific place in Buzzards Bay where the lobseters were trapped. Retrieval of information on the exact location of lobster pots would be extremely difficult, if not impossible. Calculation of catch-per-unit-effort also would be extremely difficult to retrieve. In most cases, this data is not available.

Project Design. Data collection and analysis have evolved over the past 18 years, which makes it difficult to compare data between years. Changes in license categories (see section on Format below) and data tabulated (e.g., data on landings by noncommercial lobstermen were tabulated only through 1979) have caused a lack of continuity and comparability of data.

Data are reported as statewide and county totals by license type. Between 1979 and 1980, lobster license categories were changed, with a parallel change in data reporting. For this reason, it is difficult to use these data to construct a time series covering the entire period for which annual reports are available (1967-84).

Several aspects of the data set are significant in terms of consistency. For 18 years, the data have been collected from catch reports filed annually by lobstermen as part of the license renewal process. Summary statistics have been consistently based on actual catch reports received by the DMF and have never been projected to 100 percent levels. Summary statistics have been reported annually in a standard format, except for the category changes noted above.

Quality Assurance/Quality Control. According to Mr. Charles Anderson of the DMF's Cat Cove Marine Lab in Salem, the DMF annually audits ten percent of the catch reports. Data submitted must be substantiated with tax returns, dealer slips, or log books. The audits are not a formal, written program

included in the annual reports and it is unknown whether or not these methods have been in use throughout the entire data collection period (1967 to the present).

Availability. The data are available as summary statistics only. These summary data are contained in annual reports as described above. Individual catch reports submitted to the DMF by lobstermen are confidential. As of 1984, the lobster fishery statistics had not been computerized.

Format

Because of the changes in the lobster statistics between 1979 and 1980, the parameters in the annual reports will be listed separately for the periods 1967 to 1979 and 1980 to the present. The comparison indicates both overlap of and differences between the two periods.

Summary data available by county are as follows:

Period:	1967-1979	1980-Present
Major topics:		
	Number of fishermen	Number of fishermen
	Pounds of lobster landed	Pounds of lobster landed
	Number of pots fished	Number of pots fished
	Value of diving gear	Value of diving gear
	Number of lobsters landed	Number and value of power boats
	Ex-vessel value of lobsters landed	Number and value of non-power boats
	Number of pots fished	
	Value of diving gear	
	Number and value of inboard power boats	
	Number and value of outboard and non-power boats	

Categories of fishermen:

- Regular (full-time commercial)
  - Potmen
  - Divers
  - Potmen-Divers
- Casual (seasonal-commercial)
  - Potmen
  - Divers
  - Potmen-Divers
- Other (noncommercial)
  - Potmen
  - Divers
  - Potmen-Divers

Inside 69°W, 41°N (Inshore)

- Coastal
  - Diver
  - Potman
  - Both
- Seasonal
  - Potman
- Offshore
  - Trawl
  - Potman

Outside 69°W, 41°N (Offshore)

- Coastal
  - Potman
- Offshore
  - Trawl
  - Potman

Tables 1 and 2 illustrate the differences in data categories in use during each of these two periods of time.

For 1979, data were also compiled for 1) pounds of lobsters landed by regular fishermen by city or town landings and 2) Massachusetts inshore commercial lobster landings by month and area fished, as reported by regular fishermen. The DMF has continued to collect these data since 1980, but in slightly different form: 1) Massachusetts commercial landings inside 69°W, 41°N by month and area (as of 1982, these data exclude seasonal fisherman) and 2) pounds of lobster landed by commercial fishermen by city or town landing, inside and outside 69°W, 41°N.

Summary

As discussed above, the Massachusetts Coastal Lobster Fishery Statistics are important because they provide the only available data on lobster landings for the counties bordering Buzzards Bay. The fact that the data are summaries, not raw data, is a weakness for purposes of the Buzzards Bay Project. In addition, summarization of the data by county presents problems for users interested only in landings taking place in Buzzards Bay. It is possible, however, based on data collected by the DMF beginning in 1979, to roughly estimate the percentage of Buzzards Bay lobster landings for each county. A major disadvantage of the project design is that the data do not

TABLE 1. SAMPLE PAGE FROM 1977 MASSACHUSETTS COASTAL LOBSTER FISHERY STATISTICS SHOWING DATA CATEGORIES USED, 1967-1979.

NUMBERS OF LOBSTERS LANDED

IN MASSACHUSETTS COASTAL LOBSTER FISHERY

1977*

FISHERMAN CLASSIFICATION	COUNTIES									TOTAL
	BARNSTABLE	BRISTOL	DUKES	ESSEX	NANTUCKET	NORFOLK	PLYMOUTH	SUFFOLK	OTHER	
REGULAR POTMEN	309,934	165,104	46,915	2,021,859	4,143	321,891	886,915	764,891	26,200	4,547,852
DIVERS	8,490	66						820		9,376
POTMAN DIVERS	17,415			11,023		7,781	8,857	1,545		46,620
SUB-TOTAL	335,839	165,170	46,915	2,032,881	4,143	329,672	895,772	767,256	26,200	4,603,848
CASUAL POTMEN	380		282	5,037		917	6,678	482		13,776
DIVERS										
POTMAN DIVERS										
SUB-TOTAL	380		282	5,037		917	6,678	482		13,776
OTHER POTMEN	27,997	6,450	3,200	43,430	391	10,403	51,460	14,813	2,057	160,201
DIVERS	7,542	305	123	24,685		1,942	11,251	6,611	2,934	55,393
POTMAN-DIVERS	3,449	246	39	5,900		1,538	5,463	2,350	433	19,418
SUB-TOTAL	38,988	7,001	3,362	74,015	391	13,883	68,174	23,774	5,424	235,012
TOTAL	375,207	172,171	50,559	2,111,933	4,534	344,472	970,624	791,512	31,624	4,852,636

* *Based on annual reports filed by fishermen*

Division of Marine Fisheries

TABLE 2. SAMPLE PAGE FROM 1980 MASSACHUSETTS LOBSTER FISHERY STATISTICS SHOWING DATA CATEGORIES USED, 1980-1984.

1980 MASSACHUSETTS LOBSTER FISHERY
SUMMARY STATISTICS--COMMERCIAL

PLYMOUTH COUNTY

LICENSE TYPE	GEAR TYPE AND NUMBER	DIVING GEAR VALUE	POTS FISHED	POWER BOAT	BOAT VALUE	NON-POWER BOAT	BOAT VALUE	POUNDS OF LOBSTER
Taken Inside 69°W 41°N								
COASTAL	Diver							
	Potman	298		59,801	298	3,731,430	1	200	1,939,108
	Both[1]	4	1,995	604	4	28,500			9,760
SEASONAL	Potman	75		1,527	71	164,009	1	200	24,116
OFFSHORE	Trawl	15			15	254,750			22,904
	Potman	12		1,215	12	80,950			9,342
TOTAL		404	1,995	63,174	400	4,259,639	2	400	2,005,230
Taken Outside 69°W 41°N								
OFFSHORE	Trawl								
	Potman[2]								20,449
COASTAL	Potman								
TOTAL									20,449
GRAND TOTAL		404	1,995	63,174	400	4,259,639	2	400	2,025,679

[1]Diver and Both combined to protect confidentiality

[2]Gear and vessel information included above

quantify the lobster catch inside as opposed to outside Buzzards Bay. While the currently available data may be useful in assessing the economics of the lobster fishery based in Buzzards Bay, they do not provide information on the lobster resource within the Bay. Data on catch location would be of great value to the Buzzards Bay Project and DMF should be urged to request such information on catch reports submitted by lobster fishermen in the future. Although the temporal aspects of data collection are good, changes in categories of data collected between 1979 and 1980 make if difficult to compare data over time.

Water Quality and Nutrients

Introduction

Twenty-two data sets were identified for the topic of water quality and nutrients; four sets were determined to be high priority. High priority data sets are discussed below; low priority sets are described in Appendix III.

Hydrographic Study of Buzzards Bay, 1982-1983

Dr. Leslie K. Rosenfeld
CIMAS/Univ. of Miami
460 Rickenbacker Avenue
Miami, FL 33149

Description of the Data Set

This data set contains water quality data collected for Buzzards Bay on four hydrographic cruises conducted seasonally during 1982-1983. The data were published by the Coastal Research Center at the Woods Hole Oceanographic Institution as part of an ongoing effort to provide more complete information on coastal environmental quality. The report citation is as follows:

> Rosenfeld, L.K., R.P. Signell, and G.G. Gawarkiewicz. 1984. Hydrographic Study of Buzzards Bay, 1982-1983. Technical Report, WHOI-84-5, Coastal Research Center, Woods Hole Oceanographic Institution, Woods Hole, MA.

Raw data collected included temperature, conductivity, dissolved oxygen, light transmission, pressure, and salinity. The report presents data on temperature, salinity (calculated from conductivity), light transmission, and sigma-t.

Evaluation of the Data Set Based on the Screening Criteria

The water quality data provided in Rosenfeld et al. (1984) and on the associated data tape are both relevant and useful to the Buzzards Bay Project because they cover a wide region of the Bay. For the most part, the set passed through all of the screening filters; exceptions are discussed below.

Coverage. Although temporal coverage is limited to only one year (1982-1983) the data set provides good seasonal coverage of water quality in the Bay, the four cruises having been conducted in July and October 1982, and January and May 1983.

Broad spatial coverage of the Bay is a strong point of the data set. During each cruise, one transect along the axis of the Bay was conducted. Three cross-bay transect lines were charted: one near the mouth; one at mid-bay, extending from outer New Bedford Harbor to the southwest end of Naushon Island; and a third farther up the Bay stretching from near Mattapoisett Neck to Uncatena Island. Approximately 40 stations were located at 4-km intervals along the axis and at 3-km intervals along the cross-bay transects.

During the third cruise, coverage was expanded to encompass the area near Sippewissett Marsh, Cape Cod Canal, parts of Cape Cod Bay, and Vineyard Sound.

Project Design. The project design for this data set was straightforward. Although only a few parameters were measured, the sampling regime provided maximum coverage of the Bay. Stations were basically consistent from cruise to cruise. Additional stations were added on the third cruise to expand coverage.

Routine sampling methods were used. A Neil Brown Instrument Systems MK III CTD and attached Sea Tech beam transmissometer (with a 25-cm path length) was used to continuously sample temperature, conductivity, dissolved oxygen, light transmission, and pressure. The data passed through a desk unit and were then subsampled and recorded by a HP85 computer. Salinity samples were analyzed with a Guideline model 6400 salinometer. Navigation and station location were determined primarily by use of Loran-C, with the additional aid of radar and visual sighting.

Quality Assurance/Quality Control. Oxygen data were deleted by Dr. Rosenfeld due to uncertainty in the values of coefficients in the algorithm used to reduce the data.

The Neil Brown Instrument Systems MK III CTD is specified by the manufacturer to provide an accuracy of ±0.5 db for pressure, ±0.005°C for temperature, and ±0.005 mmho for conductivity (which corresponds roughly to ±0.005 ppt in salinity). The instrument used was calibrated at the WHOI calibration facility in the fall of 1981. At that time a temperature offset of -0.010°C with a standard deviation of 0.001°C, and a conductivity offset of +0.010 mmho with a standard deviation of 0.003 mmho were measured. Another calibration, done in January 1982, found a temperature offset of -0.010°C and a conductivity offset of +0.006 mmho. Accuracy of the bucket thermometer used for surface temperatures was about 0.5°C. No samples were taken to calibrate the transmissometer, but the manufacturer states the accuracy to be ±0.5 percent.

Availability. One of the strengths of this data set is that the raw data (conductivity, temperature, transmissivity, pressure, and salinity) are available on NODC tape.

The report cited above contains the following: 1) vertical profiles of values averaged over one meter for temperature, salinity, sigma-t, and light transmission and 2) selected horizontal sections at depths of one and eight meters and vertical cross-sections for temperature, salinity, and sigma-t.

Format

Each station is located by latitude and longitude. The following data are given in the report cited above: station, date, depth (m), temperature (°C), salinity (ppt), sigma-t, and light transmission (percent).

Summary

These data are of particular value to the Buzzards Bay Project because they provide recent basic water quality measurements with unusually good spatial coverage of the Bay. Although the data set does not provide long-term data on water quality, seasonal coverage for the data collection period is very good. In addition, the raw data are accessible to EPA on NODC tape. Dr. Wendy Wiltse of EPA has assumed responsibility for obtaining the data tape.

Water Quality and Wastewater Discharge Data

Mr. Lawrence W. Gil
Division of Water Pollution Control
Mass. Department of Environmental Quality Engineering
Westborough, MA

Description of the Data Set

The Massachusetts Department of Environmental Quality Engineering (DEQE) has been collecting and publishing water quality and wastewater discharge data on Buzzards Bay since 1971. The data are collected as part of the agency's mandate and are contained in the following reports:

A) Mass. DEQE-Div. Water Pollution Control. 1971. Acushnet River -New Bedford Harbor Water Quality Study. Pub. No. 6046, DWPC, Westborough, MA.

B) Mass. DEQE-Div. Water Pollution Control. 1975. Buzzards Bay; Water Quality Data: Part A. Pub. No. 13510-140-25-1-84-CR, DWPC, Westborough, MA.

C) Mass. DEQE-Div. Water Pollution Control. 1975-77. Buzzards Bay; Wastewater Discharge Data: Part B. Pub. No. 10556-63-50-5-78-CR, DWPC, Westborough, MA.

D) Mass. DEQE-Div. Water Pollution Control. 1976. Cape Cod 1976 Water Quality and Wastewater Discharge Data. Pub. No. 10089-143-65-11-77-CR, DWPC, Westborough, MA.

E) Mass. DEQE-Div. Water Pollution Control. 1978-79. Buzzards Bay; Wastewater Discharge Data: Part B. Pub. No. 11, 676-33-50-12-79-CR, DWPC, Westborough, MA.

F) Mass. DEQE-Div. Water Pollution Control. 1980. Buzzards Bay Outer New Bedford Harbor: Special Water Quality Study. Pub. No. 12673-45-50-1-82-CR, DWPC, Westborough, MA.

Evaluation of the Data Set Based on the Screening Criteria

This data set is relevant and useful to the Buzzards Bay Project because it provides fairly good temporal and spatial coverage of the embayments of the Bay. Many water quality parameters are included in the DEQE data, although all parameters were not measured at each station. Strengths and weaknesses of the data set identified during the application of the screening filters are discussed below.

Coverage. DEQE water quality and wastewater discharge measurements have been taken in various locations, depending on the purpose of the study. In general, however, the data provide fairly good spatial coverage of the embayments of Buzzards Bay, with a predominance of stations on the western shore of the Bay and fewer stations on the eastern shore.

Temporal coverage spans the years 1971 through 1980, with annual data on wastewater discharges available for 1975 through 1979 and annual water quality data available for 1971, 1975, 1976, and 1980. While temporal coverage is not continuous, this data set does provide virtually the only data for water quality and nutrients with good spatial coverage in the Bay.

Project Design. Project design varied with the purpose of the project. Within both the water quality and the wastewater discharge studies, however, parameters measured varied widely both from year to year and from station to station within yearly data collections.

Only in the 1980 study were station locations identified by Loran T.D. and latitude-longitude.

Quality Assurance/Quality Control. All of the DEQE samples were analyzed in accordance with current American Public Health Association (APHA) Standard Methods for the Examination of Water and Wastewater. No other informal or formal written QA/QC program was specified.

Availability. The data are available in hard copy only and are contained in the DEQE reports listed above.

Format

The data categories included in the reports are presented in Tables 3 and 4. Letters used to identify the reports in the section above entitled Description of the Data Set are used in Tables 3 and 4.

Summary

Although this data set has significant weaknesses, particularly in project design and quality assurance/quality control, the data are important because they provide fairly good temproal and spatial coverage of the major embayments within Buzzards Bay for many water quality parameters. This contribution is not made by any other data set identified during this project.

TABLE 3. PARAMETERS INCLUDED IN THE DEQE WATER QUALITY DATA, (all parameters were not measured at each station).

Parameter	Report A	B	D	F
Station No.	x	x	x	x
Station (lat-long)				x
Station (Loran T.D.)				x
Date	x	x	x	x
Time	x	x		
Depth (m)	x			
Water Quality Analyses:				
Temperature (^{o}F or ^{o}C)	x	x		x
Salinity (ppt)				x
Dissolved oxygen (mg/l)	x	x		x
5-day BOD (mg/l)	x	x	x	x
2-, 5-, 7-day BOD (mg/l)		x		
Long-term BOD (mg/l)	x			
COD (mg/l)		x		
Suspended solids (mg/l)	x	x	x	x
Total solids (mg/l)		x	x	
pH (standard units)	x	x	x	
Alkalinity (mg/l)	x	x	x	
Total coliform bacteria (mpn/100 ml)	x	x	x	x
Fecal coliform bacteria (mpn/100 ml)			x	x
Total phosphorus (mg/l)	x	x	x	x
Chlorides (mg/l)	x	x	x	x
Chlorphyll a (mg/l)	x			x
Color (standard units)	x	x		
Turbidity (standard units)	x		x	
Specific conductivity (micromhos/cm)	x		x	
Approx. specific gravity				x
Kjeldahl-Nitrogen (mg/l)	x			x
Ammonia-Nitrogen (mg/l)	x	x	x	x
Nitrate-Nitrogen (mg/l)	x	x	x	x
Iron (mg/l)		x		
Magnesium (mg/l)			x	
Chromium (mg/l)		x		
Lead (mg/l)		x		
Mercury (mg/l)		x		
Nickel (mg/l)		x		
Zinc (mg/l)		x		
Sulfate (mg/l)			x	
Calcium (mg/l)			x	
Manganese (mg/l)		x		

TABLE 3. (Continued)

Parameter	Report A	B	D	F
Water Quality Analyses (Cont):				
Microscopic examinations (areal standard units/ml):				
Blue-green algae	x	x		
Green algae	x	x		
Flagellates	x			
Diatoms	x	x		
Protozoa		x		
Crustacea (No. organisms)	x	x		
Rotifera (No. organisms)	x	x		
Amorphous matter (areal standard units/cubic cm)	x	x		
Photosynthesis data:				
Initial D.O. (mg/l)	x			
Light D.O. (mg/l)	x			
Dark D.O. (mg/l)	x			
Light-Dark Photosynthesis	x			
Initial-Dark Photosynthesis	x			
Sediment Analyses:				
Mercury (mg/kg)	x	x		x
Cadmium (mg/kg)	x			x
Lead (mg/kg)	x	x		x
Zinc (mg/kg)	x	x		x
Nickel (mg/kg)	x	x		x
Copper (mg/kg)	x			x
Chromium (mg/kg)	x	x		x
Arsenic (mg/kg)	x			x
Iron (mg/kg)		x		
Manganese (mg/kg)		x		
Percent organic matter	x			
Percent Volatile Solids			x	x
PCBs				x

See section entitled Description of the Data Set for reports referred to above by letters.

TABLE 4. PARAMETERS INCLUDED IN THE DEQE WASTEWATER DISCHARGE DATA (Effluent and Influent) (All parameters were not measured at each discharge point).

Parameter	Report C	D	E
Location	x	x	x
Date	x	x	x
Time	x		
Type of sample	x	x	
Temperature (°F)	x	x	
COD (mg/l)	x		x
5-day BOD (mg/l)	x	x	x
pH (standard units)	x	x	
Total alkalinity (mg/l	x	x	x
pHth alkalinity (mg/l)	x	x	
Suspended solids (mg/l)	x	x	x
Settleable solids (ml/l)	x	x	x
Total solids (mg/l)	x		x
Total Kjeldahl-Nitrogen (mg/l)		x	x
Ammonia-Nitrogen (mg/l)	x	x	x
Nitrate-Nitrogen (mg/l)	x	x	x
Total phosphorus (mg/l)	x	x	x
Total coliform (per 100 ml)	x	x	x
Fecal coliform (per 100 ml)	x	x	x
Chlorine residual	x		x
Total Chromium (mg/l)	x	x	x
Hexavalent Chromium (mg/l)	x		x
Zinc (mg/l)	x	x	x
Copper (mg/l)	x	x	x
Aluminum (mg/l)	x	x	
Nickel (mg/l	x	x	x
Cyanide (mg/l)	x		
Iron (mg/l)	x	x	
Chlorides (mg/l)		x	
Vanadium (mg/l)		x	
Manganese (mg/l)		x	
Lead (mg/l)			x
Oil and grease (mg/l)	x	x	x
Flow (MGD)	x	x	x
(cfs)	x		
(GPD)		x	

See section entitled Description of the Data Set for reports referred to above by letters.

In addition, although the data are not in a computer database, they are readily accessible in the reports listed above.

Coliform Data Summary

A number of data sets containing coliform data were identified. Although individually these data sets offer limited spatial and temporal coverage, together they provide historical coliform bacteria data not otherwise available for Buzzards Bay.

Temporal and spatial coverage, sampling methods and frequency, and parameters measured vary widely among the data sets. Spatial coverage of the combined data sets, however, includes most of the major embayments of the Bay. A summary of the coliform bacteria data sets is presented in Table 5. Two high priority water quality data sets contain coliform data. They are as follows:

Water Quality Wastewater Discharge Data

Mr. Lawrence W. Gil
Division of Water Pollution Control
Mass. Department of Environmental Quality Engineering
Westborough, MA

(See previous section for a description of this data set.)

City of New Bedford Section 301(h) Applications for Modification of Secondary Treatment Requirements for Discharges into Marine Waters, 1979 and 1983

Camp Dresser and McKee, Inc.
Boston, MA

(See next section for a description of this data set).

Other data sets that provide historical coverage of coliform bacteria in Buzzards Bay are described below.

TABLE 5. SPATIAL AND TEMPORAL COVERAGE OF DATA SETS CONTAINING COLIFORM DATA (MPN=Most Probable Number Technique; MF=Membrane Filter Technique).

Data Set (Contact)	Spatial Coverage	No. of Stations	Temporal Coverage	Frequency of Sampling	Method
MA Sanitary Survey-1972 (Dowgert)	Mattapoisett Harbor Wareham River	21	8/72	One week	MPN
Cape Cod Shellfish Survey-1981 (Dowgert)	Western shore of Buzzards Bay	15	7/81	One week	MPN MF
Buttermilk Bay Sanitary Surveys-1985 (Dowgert)	Buttermilk Bay, Little Buttemilk Bay	40	7/85	Two weeks	MPN
Buzzards Bay, MA Coliforms (Fantozzi)	Buttermilk Bay Little Buttermilk Bay, Waters adjacent to town of Buzzards Bay	12	Mar-Nov	Weekly, many years	MF
Marion, MA Coliforms (Taft)	Marion Harbor	5-6	Ongoing Summer	Monthly	Unknown
Buzzards Bay Coliforms (Davies)	Throughout embayments of Buzzards Bay	>10	Ongoing 1975-present	3 times per year	MPN
New Bedford Harbor Pathogens (Hall)	Mouth of Westport and Slocums Rivers, So. Dartmouth, Clark Cove, New Bedford Harbor	17	7/74-10/75	Irregular	MF
DEQE 1971 (Gil)	Acushnet River, New Bedford Outer Harbor	17	7/71	Two days	MPN
DEQE 1975 (Gil)	Western Shore Buzzards Bay: Westport to Bourne	61	7/75+ 8/75	Four days	MPN

TABLE 5. (Continued).

Data Set (Contact)	Spatial Coverage	No. of Stations	Temporal Coverage	Frequency of Sampling	Method
DEQE 1976 (Gil)	Eastern shore Buzzards Bay, Woods Hole	60	6/76	Two weeks	Both MF and MPN
DEQE 1975-77 (Gil)	Western Shores Buzzards Bay: Westport to Bourne	22	10/75, 9/76+ 9/77	Annually	Both MPN and MF
DEQE 1978-79 (Gil)	Western Shore Buzzards Bay: Westport to Bourne	7	10/78+ 8/79	Annually	Both MPN and MF
DEQE 1980 (Gil)	Outer New Bedford Harbor	4	7/80	One day	?MPN
New Bedford 301(h) Application 1983(CDM)	New Bedford Harbor	10	8/83+ 10/83	Two weeks	Unknown
Wareham Coliforms (Wakefield)	Wareham public beaches	10	Ongoing Summer	2 times per month	MPN
Estuarine Research Program (Churchill)	Westport River Estuary	8	7/66	One day	MPN
Buzzards Bay Disposal Sites (Gilbert)	Throughout main axis of Buzzards Bay	14	5/73	One week	Unknown

Massachusetts Sanitary Surveys - 1972

Mr. Martin Dowgert and
Mr. Ira Somerset
U.S. Food and Drug Administration
Stoneham, MA

In 1972, the Northeast Technical Services Unit of the U.S. Food and Drug Administration collected water quality data in three Massachusetts estuaries, two of which are located in Buzzards Bay, Mattapoisett Harbor and the Wareham River. The purpose of the program was to 1) supplement existing water quality data, 2) provide insight into the sanitary significance of bacteriological data, and 3) affirm existing classifications of shellfish areas.

Coliform bacteria, salinity, and temperature data were taken by the FDA. Eleven stations in Mattapoisett Harbor and Crescent Beach and ten stations in the Wareham River were sampled. Temporal coverage was limited to one week during August 1972.

The following report contains the raw data:

> U.S. Department of Health, Education, and Welfare. 1972. Sanitary Surveys - 1972; Massachusetts: Chase Garden Creek, Scorton Creek, Wareham River and Mattapoisett Harbor. Northeast Technical Services Unit, Shellfish Sanitation Branch, Food and Drug Administration, Public Health Service, U.S. Department of Health, and Human Services.

Data reported were: station, date, time, tidal stage, temperature (^{o}C), salinity (ppt), total coliform, and fecal coliform. No units are given in the report for coliform data. Stations are not identified by latitude-longitude. FDA's formal quality assurance/quality control program was applied to this data set. Maps are included.

Cape Cod Shellfish Area Survey - 1981

Mr. Martin Dowgert
and Mr. Ira Somerset
U.S. Food and Drug Administration
Stoneham, MA

The U.S. Food and Drug Administration (FDA) collected salinity, temperature, and coliform data in Cape Cod waters in July of 1981. Areas sampled in the FDA study of interest to the Buzzards Bay Project included the following sites on the western shore of the Bay: Red Brook Harbor, Hospital Cove, Handy Point, Hen Cove, Barlow's Landing, Pocasset, Long Point, West

Falmouth Harbor, Little Sippewissett, North Falmouth Harbor, Wild Harbor, Megansett, and Squeteage Harbor, as well as Little Harbor and Great Harbor at Woods Hole.

This data set is not published in report form, only as tables. FDA's formal quality assurance/quality control program was applied to the data.

Data reported include station number, date, time, salinity (ppt), temperature (°C), total and fecal coliform bacteria measured by the most probable number/100 ml method and by the membrane filter method (MFC/100 ml and PSE/100 ml). Stations are not identified by latitude-longitude. Maps are included.

Buttermilk Bay Sanitary Surveys-1985

Mr. Martin Dowgert and
Mr. Ira Somerset
U.S. Food and Drug Administration
Stoneham, MA

A study was completed in July 1985 to determine sources of water entering Buttermilk Bay that influence shellfish beds. Approximately 40 stations were sampled for total and fecal coliform. The data are at present not well documented. A formal report on these data will be available in July of 1988, at which time this data set should become a high priority one.

Coliform Bacteria in the Waters Adjacent to Buzzards Bay, MA

Ms. C. Coffin
Board of Health
Bourne, MA

The Bourne, MA Board of Health monitors local waters for total and fecal coliform bacteria. No other water quality parameters are measured. This program has been ongoing for many years, with samples collected either by the Board of Health or the Massachusetts Department of Environmental Quality Engineering, or the Barnstable County Health Department. Samples are taken weekly from March through November at approximately 12 stations in Buttermilk Bay, Little Buttermilk Bay, and near the town of Buzzards Bay. Storm drain samples are also collected as needed. Specific, but unwritten, quality control procedures are used. Data are available in laboratory notebooks and laboratory analysis reports and have been tabulated but not published.

Coliforms in Water and Shellfish of Marion, MA

Mr. Chris Taft
Shellfish Constable
Mass. Department of Natural Resources
Marion, MA

This ongoing program is designed to monitor fecal coliforms in Marion Harbor during swimming months and fecal coliform levels in shellfish as needed. Water at five or six stations is sampled monthly for fecal coliforms during the summer. No other water quality parameters are measured. The data are available in handwritten form only.

Coliform Bacteria in Buzzards Bay

Ms. Tina Davies
Southeast Regional Office
Mass. Department of Environmental Quality Engineering
Lakeville, MA

The Shellfish Sanitation Section of the Massachusetts Department of Environmental Quality Engineering (DEQE) has been sampling Buzzards Bay waters for coliform bacteria and salinity since 1975 to classify shellfish growing areas. Shellfish meats are also tested for petroleum and aliphatic hydrocarbons, PCBs, and mercury when a spill is reported or contamination suspected. Sampling is conducted three times per year (5 times per year since 1987) at times of "adverse conditions", such as after heavy rainfalls. During sanitary surveys, sampling is more intensive. Stations are located in areas of maximum impact, such as storm drains and shellfish beds. Standard U.S. Food and Drug Administration (FDA) procedures are followed. The DEQE laboratory is FDA certified every two years. Coliform bacteria are measured by the Most Probable Number (MPN) method. After March 1, 1987, the fecal coliform standard was adopted by DEQE and the A-1 MPN method employed. Data are available in handwritten and hard copy only and are open to public inspection by appointment. The data have been requested and some have been received. These data will be included in a data synthesis review. The shellfish closure process transferred from DEQE to DMF on January 1, 1988.

Occurrence of Salmonella and Vibrio parahaemolyticus in the New Bedford Area of Buzzards Bay

Mr. Joseph Hall
Southeastern Massachusetts University
North Dartmouth, MA

This study was a Masters thesis conducted to determine whether two bacteriological pathogens occur in the waters of Clarks Cove and New Bedford Harbor. Data on temperature, salinity, dissolved oxygen, pH, nutrients (nitrates, nitrites, dissolved organic nitrogen, and phosphates), biological oxygen demand, and total and fecal coliform bacteria were collected irregularly at 17 stations in Buzzards Bay between July 1974 and October 1975. In addition, coliform counts in marine invertebrates were compared to coliform counts in overlying seawater. Coliform counts were determined by the Membrane Filtration technique. The stations were located one each at the mouths of the Westport and Slocums River and at Goosebery Neck; two in South Dartmouth; and twelve in Clarks Cove and New Bedford Harbor. A formal written quality control program was followed.

The citation for the thesis is as follows:

Hall, J.N. 1979. Occurrence of Salmonella and Vibrio parahaemolyticus in the New Bedford Area of Buzzards Bay. A thesis presented to the Faculty of the Biology Department of Southeastern Massachusetts University.

Mr. Hall's data have been requested but Mr. Hall is uncertain of their whereabouts.

Coliform Bacteria in Waters Adjacent to Wareham, MA

Mr. Carl Wakefield
Board of Health
Wareham, MA

The Wareham Board of Health collects coliform bacteria data at approximately 10 public beaches twice a month from early May through September each year. The data are analyzed by the Most Probable Number method. The data are available in untabulated form only and may be obtained by visiting the Board of Health and having the relevant data xeroxed.

Estuarine Research Program

Division of Marine Fisheries
Mass. Department of Fisheries, Wildlife, and Recreational Vehicles
Boston, MA

The Division of Marine Fisheries initiated a series of estuarine studies in 1963. One of the estuaries, the Westport River Estuary, is located in Buzzards Bay. Monthly water quality data were collected from June 1966 through April 1967 and included temperature, salinity, pH, dissolved oxygen, detergents, coliform bacteria, and nutrients. The number and relative abundance of finfish species occurring in the estuary were also studied and a general inventory of shellfish beds was conducted. The data are presented in the following report:

> Fiske, J.D., J.R. Curley, and R.P. Lawton. 1968. A Study of the Marine Resources of the Westport River. Monograph Series Number 7, Division of Marine Fisheries, Massachusetts Department of Natural Resources, Boston, MA.

No additional estuarine studies have been conducted by the Division of Marine Fisheries since the 1960s.

Site Selection and Study of Ecological Effects of Disposal of Dredged Materials in Buzzards Bay, MA

Dr. Thomas Gilbert
Chemistry Department
Northeastern University
Boston, MA and
Dr. Al Barker
New England Aquarium
Boston, MA

The U.S. Army Corps of Engineers funded this study to evaluate water quality and sediment characteristics of Buzzards Bay, to assess potential ecological effects of disposing dredged materials in the Bay, and to determine factors affecting site selection. Samples were taken throughout the main axis of the Bay. Water column measurements included temperature, salinity, dissolved oxygen, pH, nutrients, turbidity, chlorophyll, total coliform bacteria, and four metals. Sediment measures included grain size, percent organic matter, hydrocarbons, PCBs, percent solids, several metals, and sulfide. While the data looked potentially valuable for characterization of a large area of the main axis of the Bay, their location is unknown. Dr. Gilbert, main author of the report on this study, indicated that the raw data may be in a file somewhere at the Aquarium, but the only data readily available now are in the report. The report citation is:

Gilbert, T., A. Clay and A. Barker. 1973. Site selection and study of ecological effects of disposal of dredged materials in Buzzards Bay, Massachusetts. Prepared for the Department of the Army, New England Division, Corps of Engineers by the Research Department, New England Aquarium, Boston, MA.

Because no comprehensive data set offering broad spatial and temporal coverage is available, EPA may wish to consolidate coliform data sets discussed above to create a coliform data set for the Bay. Accomplishment of such a consolidation of the data would require significant resources due to the relative inaccessibility of the coliform bacteria data, all of which are available only in hard copy and many of which have not even been tabulated.

City of New Bedford Section 301(h) Applications for Modification of Secondary Treatment Requirements for Discharges into Marine Waters, 1979 and 1983

Camp Dresser and McKee, Inc.
Boston, MA

Description of the Data Set

This data set was developed by Camp Dresser and McKee (CDM) to support applications to EPA filed by the City of New Bedford in 1979 and 1983 for National Pollutant Discharge Elimination System (NPDES) permit waivers of secondary treatment from EPA.

Water quality analyses of marine receiving waters in the vicinity of New Bedford and effluent from the New Bedford wastewater treatment plant were conducted in 1979 and 1983. Also included in CDM's reports are data on toxic pollutants in sediment and shellfish samples from the New Bedford area.

Water quality parameters measured by CDM in July 1979 at 11 stations in New Bedford coastal waters included temperature, conductivity, dissolved oxygen, and pH. Salinity and density were calculated from the data collected. Current and temperature data were also collected at three locations in New Bedford coastal waters to obtain month-long time series for those parameters.

Water quality data collected for outer New Bedford Harbor by the Water Resources Commission (1972) and the Water Quality and Research Station (1975) are presented in CDM's 1979 report. Data on PCBs in fish and shellfish

collected by Kolek and Ceurvels (1981) for the Massachusetts Division of Marine Fisheries are included in the 1983 301(h) application.

In August and October of 1983, CDM sampled 15 stations in New Bedford coastal waters for water quality parameters, including temperature, salinity, dissolved oxygen, five-day biological oxygen demand, pH, total suspended solids, total settleable solids, and total and fecal coliform bacteria. Sediments in the vicinity of the proposed outfall and control stations were analyzed for PCBs and trace metals.

Chemical analyses of effluents from the New Bedford wastewater treatment plant were conducted to fulfill 301(h) application requirements for toxic control programs. Chemical analyses included biological oxygen demand, total suspended solids, total coliforms, pH, settleable solids, chlorine residuals, volatile organics, hydrogen sulfide, oil and grease, metals, and PCBs in April, May, and June of 1979, and June and August of 1983.

Additional samples collected in August 1979 at stations located within the zone of initial dilution (ZID), beyond the boundary of the ZID, and at control stations beyond the influence of the wastewater discharge were analyzed for pesticides, toxic pollutants, heavy metals, and total suspended solids.

Evaluation of the Data Set Based on the Screening Criteria

This data set is of value to the Buzzards Bay Project because it provides historical water quality data for New Bedford, the largest city located on the shores of the Bay. Results of screening filters applied to this data set are discussed below.

Coverage. Spatial coverage was limited to New Bedford coastal waters. Temporal coverage was limited to two years, 1979 and 1983.

Project Design. The projects were designed specifically to meet requirements for 301(h) applications.

Quality Assurance/Quality Control. Formal quality assurance/quality control procedures required for 301(h) applications were used in both CDM studies and are specified in the reports cited below.

Availability. The data are available, although somewhat difficult to retrieve, in the following reports.

Camp, Dresser and McKee, Inc. 1979. City of New Bedford: Section 301(h) Application for Modification of Secondary Treatment Requirements for Discharges into Marine Waters. Vols. 1 and 2., Camp, Dresser and McKee, Inc., of Boston, MA.

Camp, Dresser and McKee, Inc. 1979. City of New Bedford: Section 301(h) Application for Modification of Secondary Treatment Requirements for Discharges into Marine Waters. Vols. 1 and 2. Camp, Dresser and McKee, Inc., Boston, MA.

Format

The water quality data collected in July 1979 include the following parameters: station, date, time, tidal stage, depth (m), temperature (^{o}C), salinity (ppt), density, pH, and dissolved oxygen. Thermograph data also given for 1979 include station, date, depth, and temperature. Shellfish and sediment samples for metals and PCBs are reported in mg/kg.

The effluent data reported for April and May, 1979 included station, compound, wet weather concentration, and dry weather concentration.

Water quality samples taken by CDM in August and October of 1983 include data on station (latitude-longitude or transponder location), surface and bottom temperature (^{o}C), salinity (ppt), dissolved oxygen (mg/l), five-day biological oxygen demand (mg/l), pH, total suspended solids (mg/l), total settleable solids (mg/l), and total and fecal coliforms (per 100 ml). All of these parameters were measured for both surface and bottom water. Metal and PCB concentrations in sediment and shellfish samples are reported in mg/kg.

Summary

This data set is limited in terms of spatial and temporal coverage. However, since New Bedford is the most populated area of Buzzards Bay, and is also a Superfund site, the data set is a high priority for inclusion in the Buzzards Bay Project database. The combination of this data set and DEQE's water quality data on the New Bedford Harbor area provide reasonably good temporal coverage of this important location in Buzzards Bay.

Toxic Substances in Organisms and Sediments

Introduction

Twenty-nine data sets were identified for the topic of toxic substances. The ten determined to constitute high priority data sets are discussed below; data sets not considered high priority are described in Appendix III.

Federal Navigation Projects

Mr. Forrest Knowles
Mr. Michael Carroll
U.S. Army Corps of Engineers
Waltham, MA

Description of the Data Set

The New England Division of the U.S. Army Corps of Engineers (ACOE) has amassed a large database of physical and chemical data on marine and estuarine sediments sampled during Federal navigation projects conducted during the past fifteen years. A summary of the data is available in the following reports:

U.S. Army Corps of Engineers. 1980. Environmental Atlas of New England Channel and Harbor Bottom Sediments. Volume II. Federal Projects within Narragansett Bay, Mount Hope Bay, Block Island, and Buzzards Bay (within the North Atlantic Tidal System). Preliminary, unverified report by the New England Division of the U.S. Army Corps of Engineers.

U.S. Army Corps of Engineers. 1980. Environmental Atlas of New England Channel and Harbor Bottom Sediments. Volume III. Section A. Federal Projects within Nantucket Sound, Vineyard Sound, and Buzzards Bay (within the Gulf of Maine Tidal System). Section B. Federal Projects within Massachusetts Bay and Cape Cod Bay. Preliminary, unverified report by the New England Division of the U.S. Army Corps of Engineers.

At the beginning of each volume are explanations of the New England Division's environmental sampling and testing programs, including sampling methods, testing procedures, and rationales. Explanations of the various physical and chemical parameters and the statistical classification system used for reporting test results for each Federal project are also presented. The second portion of each volume contains individual reports for each navigation project.

In addition to information presented in the Environmental Atlas, raw data are stored in the database management system currently maintained in Waltham, MA.

Evaluation of the Data Set Based on the Screening Criteria

These data sets were identified as useful in characterizing toxic contaminants in the sediments of Buzzards Bay. The strengths and weaknesses of the data set are discussed below.

Coverage. Table 6 presents the areas where navigation projects have been conducted, the years they were conducted, and the number of stations in each area. The New Bedford Harbor data include measurements taken at the gate holes at the Hurricane Barrier. These data should not be used to characterize the Harbor as a whole because levels of metals are high as a result of the stagnant nature of the water, accumulation of fine sediments at the site, and proximity to the Barrier. Table 6 demonstrates that each area was sampled once, with the exception of Cuttyhunk Harbor, which was sampled twice. While temporal coverage may be considered quite limited (one sampling), this information may prove useful for comparisons with newer data.

Project Design. One of the attractive aspects of the navigation projects is that analyses have been conducted only by the New England Division of the ACOE and the methods have been consistent over time and among projects. The only change in analyses was that oil and grease are now measured by infrared techniques rather than gravimetric methods. It is important to note that the same parameters were not measured for all stations within or among projects. While this inconsistency does diminish the spatial coverage somewhat, it is not enough of a problem to make this data set a low priority data set.

Quality Assurance/Quality Control. There is no specified quality assurance/quality control program. The usual standards and blanks were run for chemical analyses.

Availability. The data sets are available in hard copy. The ACOE has also computerized the data, but is currently transferring data from an offsite computer to a computer in Waltham. Therefore, only hard copies are available for the near future.

TABLE 6. U.S. ARMY CORPS OF ENGINEERS NAVIGATION PROJECTS CONDUCTED IN BUZZARDS BAY, MA.

Project Area	Project Date	Number of Stations
Cuttyhunk Harbor	1972	15
Cuttyhunk Harbor	1974	18
Woods Hole Channel	1974	4
East Boat Basin, Cape Cod Canal	1981	7
West Boat Basin, Cape Cod Canal	1974	3
West Mooring Basin, Cape Cod Canal	1979	3
Buttermilk Bay	1973	11
New Bedford Harbor	1971	45*
Slocums River	1971	11

* Does not include gateholes (see text).

Format

Analyses for the projects cover a wide variety of parameters including bulk sediment characteristics, metals, and organic substances. A list of the parameters measured is provided in Table 7.

Summary

The ACOE data set has both weaknesses and strengths. Temporal coverage at any one site is usually limited. The parameters reported were not always consistent between stations or projects. Further, parameters measured (e.g., oil and grease, and total PCBs) are not considered to represent state-of-the-art technologies. These studies were conducted in the 1970s and chemical analyses have changed since then. While standards and blanks were used in chemical analyses, no formal quality assurance and quality control programs were instituted.

The major strengths of the data sets are that the methods are consistent over time, the data are available, and the data cover a broad area spatially in the Bay. The data were collected in the 1970s and thus provide some of the earliest information available on toxic substances in Buzzards Bay. For these reasons, the data set is considered a high priority one.

Effects of the Grounding of the Barge Florida off West Falmouth, MA

Dr. J. Frederick Grassle
Woods Hole Oceanographic Institution
Woods Hole, MA

Description of the Data Set

On September 16, 1969, the barge Florida ran aground on a rocky shoal off Fassett's Point, West Falmouth, MA, and spilled 650,000 to 700,000 liters of a Number 2 fuel oil into Buzzards Bay. Strong SSW winds churned the oil into an oil-water emulsion and drove it northeastward into Wild Harbor River in North Falmouth. The oil spread over more than 1,000 acres, including four miles of coastline. Mass mortality of at least the larger marine animals occurred immediately in the intertidal and subtidal zones of the river.

Water-based oil spill dispersants were used to clean up the oil between September 16 and 19 before being prohibited by official act on the grounds that the dispersants were toxic to shellfish. A total of 17,072 liters of dispersants were used in less than four days.

TABLE 7. DATA CATEGORIES FOR U.S. ARMY CORPS OF ENGINEERS NAVIGATION PROJECTS (UNITS ARE PROVIDED WHERE AVAILABLE).

Data Category	Units
Laboratory Serial No.	
Exploration No.	
Sample No.	
Latitude	
Longitude	
Coordinate Location North	
Coordinate Location West	
Sounding	
Reduced Sounding	Mean Low Water
Date/Hour	
Sea State	
Secchi Disc-Black	
Secchi Disc-White	
Visual Classification by Laboratory	
Soil Class/Dominant	
Soil Class/Sub-dominant	
Grain Size Curve	Median
Grain Size Curve	Q1
Grain Size Curve	Q3
SRI Coefficient	(Q1/Q3)**.5
Normal/Bimodal	
Liquid Limit	
Plastic Limit	
Plastic Index	
Specific Gravity Solids	
Wet Unit Weight	PCF
Dry Unit Weight	PCF
Percent Solids	
Sediment pH	
Sediment Redox Potential	Millivolts
Volume Solids-EPA	Percent
Volume Solids-NED	Percent
Total Volume Solids-EPA	Percent
Chemical Oxygen Demand	ppm
Total Kjeldahl Nitrogen	ppm
Oil and Grease	ppm
Arsenic	ppm
Cadmium	ppm
Chromium	ppm
Copper	ppm
Lead	ppm
Mercury	ppm
Nickel	ppm
Phosphorous	ppm
Vanadium	ppm
Organic Carbon	Percent
Carbonate Carbon	Percent
Total Carbon	Percent
Hydrogen	Percent
Nitrogen	Percent
Benzene	ppm
DDT	ppb
Polychlorinated Biphenyls	ppb
Carbon 14	Years
Radioactivity	MR/Hr

On September 19, 1969, three days after the spill, sampling was begun for this project. A comprehensive publication on the study is as follows:

> Sanders, H.L., J.F. Grassle, G.R. Hampson, L.S. Morse, S. Garner-Price, and C.C. Jones. 1980. Anatomy of an oil spill: long-term effects from the grounding of the barge Florida off West Falmouth, Massachusetts. J. Mar. Res. 38:265-380.

Fifteen stations were established from Wild Harbor River south to Sippewissett Marsh. Sediments were sampled for petroleum hydrocarbons, grain size distribution, and benthic invertebrates. Hydrocarbons (discussed below) were analyzed by Dr. Max Blumer and his colleagues.

Evaluation of the Data Set Based on the Screening Criteria

The data set is considered valuable to the Buzzards Bay Program because it has the most complete information available on the response of benthic communities to the West Falmouth oil spill. A follow-up study was conducted by Dr. Allan Michael at many of the same stations. While Dr. Michael has not yet located the data from the follow-up study, he has agreed to provide them to the Buzzards Bay Project. Until the data are found, this data set is considered a low priority one (see Appendix III). Application of the screening criteria to the data set is discussed below.

Coverage. Temporal coverage is exceptionally good because the program ran for three years. The most critical stations were sampled more intensively over this three-year period than less critical stations. As one would expect, spatial coverage did not extend beyond the area of the spill. Stations were initially located in Wild Harbor River. Two months after the spill, it was possible to determine an offshore-onshore gradient of effects and sampling was limited to that gradient. Offshore stations were less heavily oiled and inshore stations most heavily oiled. A control area was eventually established in the unoiled intertidal area of Sippewissett Marsh. A total of 413 samples were collected, of which 42 percent of the benthic invertebrates were analyzed.

Project Design. Techniques that were state-of-the-art for the period of study were used in all analyses. The small sieve size used in this study (0.297 mm opening) was particularly useful in ensuring that all the benthic macrofauna were included in the analyses.

Quality Assurance/Quality Control. Although there was no formalized quality assurance/quality control program, the taxonomy was conducted by recognized experts in benthic invertebrate systematics. The chemical analyses are discussed elsewhere in this report.

Availability. The data set exists in several forms: 1) a hard copy, located in Dr. Grassle's office, contains all the most current information including recent taxonomic changes, 2) a magnetic tape at WHOI, and 3) a published report to EPA. Dr. Grassle has provided the hard copy of data from his office against which all other forms of the data should be compared and updated. The EPA report has also been obtained. Dr. Grassle indicated that obtaining the magnetic tape from the WHOI computer center would entail considerable search time. Once the data tape was located, it would require updating for accuracy. For this reason, Dr. Grassle recommended that the data set from his office be used primarily.

Format

Benthic data were reported as follows:

Density (number per 1/25 m^2)
Total number of species
Number of species per 1/25 m^2
Number of species present at mean densities greater than 3.0 per 1/25 m^2 common to each pair of stations
Percent subdominants
Coefficient of variation
Constancy
Cumulative discrepancy
Change in disparity
Diversity
Information function
Evenness
Similarity

Summary

The data set has been included among the high priority data sets because of its uniqueness in documenting the response of benthic community structure to an oil spill. Temporal and spatial coverage was quite good. Spatial coverage was not Bay-wide because the project was designed to examine only the area of the oil spill. While no quality assurance or quality control program was formalized, established experts used state-of-the-art techniques for their analyses.

It should be noted here that Dr. Allan Michael directed a two year, follow-up study on the long-term response of benthic communities to the 1969 FLORIDA oil spill. This data set, described in Appendix III, was generated using the same techniques as used by Grassle et al. in the present study. Dr. Michael has been unable to locate the data set as of the date of this report.

The West Falmouth Oil Spill

Woods Hole Oceanographic Institution
Woods Hole, MA

Description of the Data Set

The West Falmouth oil spill was described in the previous data set. Dr. Fred Grassle indicated that the oil spill data for hydrocarbons in organisms and sediments can be found in the following reports by Dr. Max Blumer:

Blumer, M., J.Sass, G. Souza, H.L. Sanders, J.F. Grassle, and G.R. Hampson. 1970. The West Falmouth oil spill: Persistence of the pollution eight months after the accident. WHOI Tech. Rept. WHOI-70-44. 32 pp.

Blumer, M., G. Souza, and J. Sass. 1970. Hydrocarbon pollution of edible shellfish by an oil spill. WHOI Tech. Rept. WHOI-70-1, 13 pp.

Blumer, M. and J. Sass. 1972. The West Falmouth oil spill. II. Chemistry. WHOI Tech. Rept. WHOI-72-19. 57 pp.

Additional data sets are also summarized in:

Burns, K.A. and J.M. Teal. 1979. The West Falmouth oil spill: Hydrocarbons in the salt marsh ecosystem. Estuar. Coast. Mar. Sci. 8:349-360.

Teal, J.M., K.A. Burns, and J. Farrington. 1978. Analyses of aromatic hydrocarbons in intertidal sediments resulting from two spills of No. 2 fuel oil in Buzzards Bay, Massachusetts. J. Fish. Res. Bd. Can. 35:510-520.

The data in the last publication were collected over a period of seven years (1971 to 1977) for two places in the Bay: Wild Harbor and Winsor Cove. The data are in the form of tables and chromatograms, with most of the chromatograms also being available in tabular form.

Evaluation of the Data Set Based on the Screening Criteria

The data provided by these reports document the fate of this oil spill. Although most of the data are presented as chromatograms, several tables are included as well.

Coverage. The sampling stations are the same as the biological sampling stations (see discussion of previous data set). Temporal coverage includes the period from September 1969 through 1977. Within that time frame, most of the stations were sampled repeatedly.

Project Design. There are two predominant strengths to the project design. First, the analytical methods used were the best available at the time of the oil spill. Second, in the case of Blumer's reports, the chemical sampling stations and events were coordinated with the biological sampling (discussed above).

Quality Assurance/Quality Control. Standard QA/QC procedures for chemical analyses were conducted.

Availability. The reports are available and have been obtained. No other form of data is available.

Format

Sediment data presented in tables in Dr. Blumer's publications include the following: sampling date, sampling locations, total hydrocarbon concentration (mg/100 g dry weight sediments), and in some cases, depth in sediment cores. Body burden data in tables include the following: species, sampling date, sampling location, total hydrocarbon concentration (mg/100 g wet weight), number of animals used per sample, and weight of the animals used. Numerous chromatograms are provided as well.

In the publication by Burns and Teal, sediment data are presented as chromatograms and tables. Data on surface sediments include the following: sampling year, sampling location, total hydrocarbon concentration (µg/g wet weight sediments), n-alkane:isoprenoid ratio, phytane:background ratio, and percent aromatics. Data on subsurface sediments include: sampling year, sampling location, depth of sample in sediments, total concentration of hydrocarbons (µg/g wet weight sediments) and the percent of total hydrocarbons attributable to biogenic sources. Data on oil content of hydrocarbon extracts

of organism tissues include organism type, sampling date and location, hydrocarbon concentration (µg/g wet weight), and the n-alkane:isoprenoid ratio.

In the publication by Teal et al., sediment data are presented as chromatograms and tables. The following are presented: sampling location and date, total hydrocarbon concentration (mg/g dry weight), and concentrations of different hydrocarbons (µg/g dry weight).

Summary

The data provided in the reports cited above, are useful for characterization of the 1969 West Falmouth oil spill. The coordination of sampling for biological and chemical samples represents a well-integrated data set. The data set passed through the filters of screening criteria and should be included as a high priority data set.

Modeling of the Transport, Distribution, and Fate of PCBs and Heavy Metals in the Acushnet River/New Bedford Harbor/Buzzards Bay System

Mr. Richard A. McGrath
Battelle New England Marine Research Laboratory
Duxbury, MA

Description of the Data Set

Under contract to NUS Corporation and Ebasco Services, Inc., Battelle is coordinating a research project to model the transport of PCBs and three heavy metals (Cd, Cu, Pb) in the Acushnet River/New Bedford Harbor/Buzzards Bay system for U.S. EPA Superfund. The program began in 1984 and is scheduled to end in mid-1988. Numerous stations (25) are being sampled to develop the database for the model. The stations extend from New Bedford Harbor above the Coggeshall Street Bridge to the Bay and from the west end of the Cape Cod Canal to Penikese Island. The majority of the stations are located in inner and outer New Bedford Harbor.

Parameters being measured include temperature, salinity, suspended solids, numerous physical oceanographic measurements, grain-size distribution, and percent organic matter. PCBs (as homologues), lead, cadmium, and copper are being measured in the sediments, water column, and biota. Body burdens and bioaccumulation rates are being measured in resource species (winter

flounder, lobster, and quahog). The physical-chemical transport study will assist with development of a food-chain model by Hydroqual, Inc. The ultimate purpose of this study is to develop a model to evaluate mitigation alternatives for in-place PCBs and metals in New Bedford Harbor.

Evaluation of the Data Set Based on the Screening Criteria

The data set was completed in 1987 and it is identified here as a high priority data set because of its utility in characterizing sections of New Bedford Harbor and Buzzards Bay and the coordinated sampling of physical, chemical, and biological data. Attributes of the data set that led to this decision are discussed below.

Coverage. Spatial coverage of the study is extensive, especially in comparison to many other studies. Samples are taken from as far north as the western end of the Cape Cod Canal and as far east as Penikese Island, with the highest concentration of stations in New Bedford Harbor. Data were collected specifically for model development.

Sampling frequency is irregular, but for the most part, seasonal. Despite the irregularities in data collection, the information is useful enough to be retained as a high priority data set.

Quality Assurance/Quality Control. A formal, written program for quality control has been developed and carried out. Such a QA/QC program is unusual among the data sets for Buzzards Bay.

Project Design. For the most part, state-of-the-art techniques are being used in this study. Degree-of-chlorination homologues of PCBs were measured instead of individual isomers or Aroclors. However, the extensiveness of the data set overrides this consideration.

Availability. When the program is complete, the data will be available to the Buzzards Bay Program with the approval of the EPA Superfund coordinator for the project, currently Mr. Frank Ciavattieri. The data will be entered into the DM database management system and stored on magnetic tape at Battelle.

Format

The DM database allows data to be output in any user-specified format.

Summary

This study of the transport, distribution, and fate of PCBs and heavy metals in the Acushnet River/New Bedford Harbor/Buzzards Bay system will provide a large amount of information regarding toxic substances in organisms and sediments in the Bay. One of the strengths of the study is that it was designed to integrate information from a number of scientific disciplines. Spatial coverage in the program is quite good, although most samples are located in New Bedford Harbor. The program offers well-defined, formal quality assurance/quality control procedures. The data are available, and this data set should be quite useful for characterization of the Bay. This data set should be prepared for transfer to the Buzzard Bay Project in a way compatible with the existing Buzzard Bay database.

Predicting Pollution Effects on Marine Zooplankton Populations

Dr. Judy Capuzzo
Woods Hole Oceanographic Institution
Woods Hole, MA

Description of the Data Set

Dr. Judy Capuzzo has recently completed a project to examine effects of PCBs on zooplankton (specifically the calanoid copepod Acartia tonsa) as part of a larger study to develop methods for analysis of the effects of lipophilic contaminants and to model zooplankton energetics. Temperature, salinity, dissolved oxygen, and chlorophyll data were collected during zooplankton sampling. Laboratory analyses examined reproductive and respiration effects of PCBs and copepod samples were archived for PCB analysis. Eight replicates were established for all laboratory treatments and experiments were run for 45 days, long enough for production of two generations of A. tonsa. Lipid analyses were conducted on adult copepods and related to effects of PCB-contaminated resuspended sediments on egg production.

All biological analyses were conducted by Dr. Capuzzo; PCB analyses will be conducted by Dr. John Farrington. The PCBs are discussed in the section on Dr. Farrington's work.

Evaluation of the Data Set Based on the Screening Criteria

The data set was considered useful to the Buzzards Bay Program in defining the effects of PCBs on planktonic populations. The application of screening criteria is discussed below.

Coverage. Sampling stations were located at inner and outer New Bedford Harbor, Cleveland Ledge, and Nantucket Sound. These stations were chosen for the range of contaminants they provide. The study was conducted from 1982 to 1983.

Project Design. State-of-the-art techniques have been used throughout the study, which should provide new information on methods for analyzing lipophilic contamination in marine organisms.

Quality Assurance/Quality Control. There was no formalized QA/QC program for the biological aspects of this study. Replication was conducted for all experiments. All oxygen and lipid analyses were conducted using appropriate QA/QC methods.

Availability. Dr. Capuzzo will provide the data from this study to EPA after she has published them.

Format

The format of the data cannot be provided because the data are not yet available.

Summary

The data set has been included among the high priority sets because it will provide useful and uncommon information on the effects of PCBs on zooplankton from three stations in Buzzards Bay and one in nearby Nantucket Sound.

PCBs in Buzzards Bay: Effects on Energetics and Reproductive Cycles of Bivalve Molluscs

Dr. Judy Capuzzo
Woods Hole Oceanographic Institution
Woods Hole, MA

Description of the Data Set

In 1984, Dr. Capuzzo and Dr. John Farrington began research on the effects of PCBs on energetic and reproductive cycles of bivalve molluscs, particularly mussels (Mytilus edulis), as part of a larger research effort to ascertain the fates of PCBs in Buzzards Bay. This study was completed in June, 1986. Three stations were established where mussels could be suspended in the water column for study: one each at the hurricane barrier in New Bedford Harbor, Cleveland Ledge, and Nantucket Sound. The Sound station serves as a clean reference site. During biweekly sampling, the following data were collected from the field: respiration, feeding, and assimilation efficiency of mussels, samples of mussels for laboratory analysis, and water quality (temperature, salinity, dissolved oxygen, pH, suspended solids, turbidity, and particulates). Respiration, feeding, and assimilation efficiency of the mussels were measured using standard techniques to assess scope for growth methods and ambient algal populations were used as the food source. Laboratory anaylses included measurements of specific chlorobiphenyl congeners and total PCB levels, PAH and trace metals in the mussels (conducted by John Farrington), stage of gonad development, and biochemical components of mussels (protein, lipids by class, carbohydrate, and ash).

Evaluation of the Data Set Based on the Screening Criteria

The data set offers useful and unusual field data which will provide important information on the fate of PCBs and PAH in marine organisms. The results of application of the screening filters are discussed below.

Coverage. It was not the purpose of this study to obtain extensive geographical coverage of the Bay. Two stations were located in the Bay and one in Nantucket Sound. Temporal coverage was reasonable, with sampling conducted biweekly for one year.

Project Design. A strength of this data set is that the study provides field research that is valuable in characterizing biological processes ongoing in the Bay. State-of-the-art methods were used throughout the program.

Quality Assurance/Quality Control. Only the chemical analyses had a formal, written QA/QC program.

Availability. Water quality data are available now and have been requested. Dr. Capuzzo has promised to provide both a hard copy and copies of the floppy disks when she has time. The remaining data for her component of the study will be available once the publication has been completed.

Format

Because the data have not been received, the format cannot yet be determined.

Summary

This data set is recommended as a high-priority set because of its potential for providing new information on the fate of PCBs in marine organisms. A strength of this data set is that specific chlorobiphenyl congeners and PAH were studied relative to their uptake by mussels. Very few analyses have been conducted in such detail. Data are available and should be requested from Dr. Capuzzo.

Polychlorinated Biphenyl (PCB) Analyses of Marine Organisms in the New Bedford Area 1976-1985

Mr. Leigh Bridges
Division of Marine Fisheries
Mass. Department of Fisheries, Wildlife, and Recreational Vehicles
Boston, MA

Description of the Data Set

In September 1976, the Massachusetts Division of Marine Fisheries (DMF) began to analyze finfish, shellfish, and crustaceans in New Bedford area waters for total PCB content. Sampling was not part of a predesigned program but was a response to requests from other government agencies for information on PCB levels in edible fish from the area. On March 8, 1977, the Massachusetts Department of Public Health (DPH) issued a warning that bottom-feeding finfish from parts of Buzzards Bay exceeded the Federal Action Level of 5 ppm. On June 3, 1977, a second warning was issued relative to consuming

lobsters. Analysis of additional samples taken from 1977-1979 resulted in DPH closures in New Bedford Harbor. Sampling has continued in New Bedford Harbor as a follow-up to the closures.

The data have been made available in two forms. One form is the following report:

> Kolek, A. and R. Ceurvels. 1981. Polychlorinated biphenyl (PCB) analyses of marine organisms in the New Bedford area 1976-1980. Div. of Mar. Fish., Publ. No. 12851-36-125-6-82-CR, 24 pp., 1 appendix.

Mr. Leigh Bridges provided the lobster data that were produced after the above report was completed, covering the period from spring 1980 through fall 1985.

Only edible portions of each sample were used for gas chromatography. Three laboratories assisted with analyses of the samples. The DMF Cat Cove Laboratory employed a Tracor MT 220 gas chromatograph (GC), the Lawrence Experimental Station of the Massachusetts Department of Environmental Quality Engineering used a Perkin-Elmer GC, and the Boston laboratory of the U.S. Food and Drug Administration employed a Tracor 560 GC. Analyses were performed following the FDA procedure in the Pesticide Analytical Manual, Volume 1, Section 212.13a. The procedure has a sensitivity of less than 0.1 ppm. The three laboratories split and analyzed six samples as a means of comparing instruments and techniques. The mean of all the samples was 5.0 ppm with a standard error of 0.7.

The 1980-1985 lobster data provided by Leigh Bridges do not include the methods, but Mr. Bridges has said that the methods have not changed from those reported in Kolek and Ceurvels (1981), cited above. Results are reported with the DMF and Massachusetts Food and Drug data presented separately.

Explanation of the Data Set Based on the Screening Criteria

On the whole, the data set has a number of problems that should preclude its selection as a high priority set. However, because there are so few data sets on toxic substances in commercially important organisms from Buzzards Bay, the data set was ranked as high priority. The results of application of the criteria to the data set are discussed below.

Coverage. Spatial coverage is limited to the New Bedford area and does not include other portions of Buzzards Bay. Temporal coverage is good. This is not entirely relevant because the species sampled are mobile. Sampling sites were revisited, but not consistently over time.

Project Design. PCBs are reported as total concentrations and no information is available for individual isomers of PCBs. In some cases, composite samples of several specimens were analyzed instead of single samples of one specimen. The lobster data for 1980-1981 represent averages of separate analyses or simply a single analysis, while the data for 1982-1985 are composite values of two to three specimens per sample. No record is provided of the size or sex of the specimens analyzed, although the methods indicate that this information was collected.

Quality Assurance/Quality Control. As was mentioned, intercalibration efforts consisted of splitting and analyzing six samples by the three laboratories to compare instruments and techniques. No formal QA/QC program is mentioned in the report.

Availability. Both the DMF report and the new DMF data sheet have been obtained for this project. The data are all in the form of hard copy.

Format

Table 8 presents a summary of the data included in the report. The 1980-1985 data are for lobsters only and are presented as parts per million wet weight in the edible portions. The 1980-1981 values represent averages of individual analyses or a single analysis, while the 1982-1985 values are composite values of two to nine individuals per sample. A total of 11 stations were sampled. The DMF and Massachusetts Food and Drug Administration data are presented separately for 1980-1985.

Summary

Despite the problems with the data set that have been discussed, the set is recommended for entry into the database management system because it covers a wide number of species and provides ten years of data for the American lobster (Homarus americanus). The long-term nature of the data set for this species is very unusual. The large number of species analyzed through the early part of the study is also unusual.

TABLE 8. SUMMARY OF DATA INCLUDED IN THE 1981 REPORT OF THE MASSACHUSETTS DIVISION OF MARINE FISHERIES (SEE TEXT FOR DETAILS).

Species	Number of Sites Sampled	Number of Sampling Dates	Range of Values (ppm)
Winter Flounder	19	5	0-13.0
Striped Bass	2	4	0.4-2.7
Bluefish	2	2	1.0-16.5
American Eel	6	6	11.0-730.0
Scup	6	3	0-11.4
Summer Flounder	7	5	0.2-10.0
Windowpane Flounder	3	2	3.1-14.3
Tautog	7	4	0.1-4.6
Silver Hake	1	1	0.7
Red Hake	1	1	0.1
Fourspot Flounder	1	1	0.8
Cunner	1	1	20.0
Black Sea Bass	1	1	0.4
Butterfish	1	1	0.3
Blue Crab	6	3	1.0-5.6
Soft-shelled Crab	3	2	14.6-53.0
Oyster	1	1	15.8
Quahog	19	3	0.2-1.8
Lobster	24	35	0.8-68.2

Polychlorinated Biphenyl Analytical Survey of Buzzards Bay, MA

Dr. Paul Boehm
Battelle New England Marine Research Laboratory
Duxbury, MA

Description of the Data Set

In 1983, a small data set was generated from a study of PCBs in the bivalve Pitar morrhuana and the lobster Homarus americanus and of coprostanol, total steroids, and PCBs in sediments. This data set was produced as an extension of previous work conducted by the chemistry team of NOAA's Northeast Monitoring Program. Eight stations were sampled: one in New Bedford Harbor, six down the main axis of the Bay, and one outside of the Bay on Browns Ledge. PCBs were reported as isomeric groups (e.g., dichloro-, trichloro-, heptochlorobiphenyls). The relevant publication is as follows:

Boehm, P.D. 1983. Polychlorinated biphenyl (PCB) analytical survey of Buzzards Bay in Massachusetts. Rept. submitted to Natl. Mar. Fish. Serv., NOAA, U.S. Dept. of Commerce, 16 pp.

Explanation of the Data Set Based on the Screening Criteria

Although the data set is small, it is identified as high priority because its information is expected to be useful in characterizing the main axis of the Bay. The application of the screening criteria is discussed below.

Coverage. The study was not designed to assess temporal coverage and only one set of samples was taken. However, this information is the only data available for some of the stations. Although eight stations were sampled in or near the Bay, they were sampled differentially as follows:

Sediments, Pitar, and Lobsters	New Bedford Harbor, Sta. 36
Sediments and Lobster	Coxens Ledge
Pitar and Lobster	Sta. BB
Pitar Only	Negro Ledge
Lobster Only	Browns Ledge
Sediments Only	Stas. 41 and 42

Project Design. The methods used were reliable. The steroid, coprostanol, although not commonly analyzed, is useful in determining sources of sewage. Isomeric groups of PCBs were reported collectively, rather than as individual isomers.

Quality Assurance/Quality Control. QA/QC procedures involved internal standards and blanks for the chemical analyses.

Availability. All available data are included in the report, which has been obtained.

Format

Numeric data for Pitar and lobster included station location and concentration of PCBs µg/g (wet tissue) for isomeric groups and total. Numeric data for sediments included station location; total PCB concentrations (µg/g dry weight) by replicate, mean, and standard deviation for each station; concentrations (µg/g dry weight) of isomeric groups of PCBs by station replicate; coprostanol (µg/g dry weight) by replicate, mean, and standard deviation for each station; coprostanol to total steroids ratio by replicate, mean, and standard deviation for each station; and coprostanol to PCB ratio for each replicate, mean, and standard deviation for each station. Sample gas chromatograms are also provided.

Summary

This data set is small, but it should still prove useful in characterizing the main axis of the Bay in terms of toxic substances in organisms and sediments. Unfortunately, temporal coverage is minimal. However, this data set was retained as a high priority set because of the geographic distribution of the stations.

Acushnet River Estuary PCBs Data Management

Mr. Nick Pangaro, Mr. Tom Fitzgerald,
Ms. Ann Shortelle
GCA Corporation
Somerville, MA and
Dr. Robert Reimold
Metcalf and Eddy/Engineers
Boston, MA

Early in the 1980s, the U.S. EPA contracted with Metcalf and Eddy/Engineers (M&E) to produce a data tape comprising all the relevant PCB and metals data for the Acushnet River estuary. In 1983, M&E produced a report entitled "Acushnet Estuary PCBs Data Management Final Report." The report contained a very general summary of the contents of the data tape and

an appendix with a list of parameters included on the data tape. The report does not indicate exactly which data sets are included on the tape. This report has already been provided to EPA.

Since the production of the report, the Superfund Branch of EPA has contracted with GCA Corporation to update the M&E data tape and to conduct a quality assurance analysis of the data to ensure its accuracy. GCA provided a list of the references that are included on the data tape. It has not been possible to track down all these references. Many of the references are memos and letters and do not appear to contain potential data. Other references are analytical results of the Massachusetts Division of Marine Fisheries and Department of Environmental Quality Engineering. Many but not all of the references on the GCA tape have been obtained.

The type and magnitude of changes in the M&E tape by GCA is unknown. We recommend that when the GCA data tape is available, the particular data sets should be obtained for evaluation. Only then can reasonable decisions be made regarding suitability of the data for entry into the database management system.

Analysis of Hydrocarbons and PCBs in Buzzards Bay

Dr. John Farrington
Woods Hole Oceanographic Institution
Woods Hole, MA

The many data sets that have been generated by Dr. John Farrington and his research group, discussed collectively here, will not be presented in the same format as the other high priority data sets. The main reason for this difference is that the data set is a composite of the research conducted in Farrington's laboratory. Obtaining Dr. Farrington's data has been difficult and the process is not yet complete. In recent years, Dr. Farrington has been reluctant to provide raw data until the interpretation of the data for the original purpose has been completed. This reluctance is based on his concern that uninterpreted data, without qualifiers, will be misused or misinterpreted.

The data of interest exist in a number of places. One source of information is a large, summary data table generated by scientists in Dr. Farrington's laboratory, including data up to 1983. This table is cited as follows:

Farrington, J.W., A.C. Davis, and J. Sulanowski. 1982. PCBs in Buzzards Bay Harbor samples. Unpublished results, Woods Hole Oceanographic Institution, Woods Hole, MA.

The summary table contains data on PCBs in sediments, particulates in water, polychaetes, molluscs, transplanted mussels, lobsters, crabs, teleost fish, and squid. Information given includes sample type, date, station location and number, and concentration (µg/gdw) of Arochlors 1242 and 1254. Stations are not identified by latitudes and longitudes.

Other major sources of data are the publications mentioned in the Buzzards Bay Bibliography produced by Bruce Tripp. They are as follows:

Farrington, J.W. 1977. The biogeochemistry of oil in the ocean. Oceanus 20(4): 5-14.

Farrington, J.W., S.M. Henrichs, and R. Anderson. 1977. Fatty acids and Pb-210 geochronology of a sediment core from Buzzards Bay, Massachusetts. Geochim. Cosmochim. Acta 41(2): 289-296.

Farrington, J.W., C.L. Lee, S.M. Henrichs, and R.B. Gagosian. 1977. Lipid biochemistry of a Buzzards Bay, Massachusetts sediment core. Geol. Soc. Am. Abstr. 9(7): 971-972.

Farrington, J.W., N.M. Frew, P.M. Gschwend, and B.W. Tripp. 1977. Hydrocarbons in cores of northwestern Atlantic coastal and continental margin sediments. Est. Coast. Mar. Sci. 5(6): 793-808.

Farrington, J.W. 1979. Geochemistry of fossil fuel hydrocarbons in marine sediments; selected aspects. In: Advances in Marine Environmental Research (ed. F.S. Jacoff), pp. 68-78.

Farrington, J.W. 1982. Annual Report of the Coastal Research Center of Woods Hole Oceanographic Institution. Woods Hole Oceanog. Inst. Tech. Rept. WHOI-82-15, Woods Hole, MA.

Farrington, J., A. Davis, N. Frew, and K. Rabin. 1982. No. 2 fuel oil compounds in Mytilus edulis, retention and release after an oil spill. Mar. Biol. 66: 15-26.

Farrington, J.W., R.W. Risebrough, et al. 1982. Hydrocarbons, PCBs, and DDT in mussels and oysters from the U.S. coast, 1976-1978--The Mussel Watch, Woods Hole Oceanog. Inst., Woods Hole, MA, 18 pp.

Farrington, J.W., B.W. Tripp, A.C. Davis, and J. Sulanowski. 1985. One view of the role of scientific information in the solution of environ-economic problems. In: Proceedings of the International Symposium on Utilization of Coastal Ecosystems: Planning, Pollution, Productivity, 22-27 November 1982. Rio Grande, R.S. Brazil (eds. L. Chao and W. Kirby-Smith).

Henrichs, S.M. and J.W. Farrington. 1987. Geochim. Cosmochim. Acta, 51, 1-15.

Farrington, J.W. et al. 1986. In: Organic Marine Geochemistry (M. Sohn, ed.), ACS Symposium Series No. 305, Amer. Chem. Soc., pp. 174-197.

Brownawell, B.J. and J.W. Farrington. 1986. Geochim. Cosmochim. Acta, 50, 157-169.

Farrington, J.W. and J. Westall. 1986. In: The Role of the Oceans as a Waste Disposal Option (G. Kullenberg, ed.), Proc. NATO Advanced Research Workshop, D. Reidel Publ. Co. pp. 361-425.

Brownawell, B.J. and J.W. Farrington. 1985. In:. Marine and Estuarine Geochemistry (A.C. Sigleo and A. Hattori, eds.), Lewis Publ. pp. 97-120.

Farrington, J.W. 1986. Technical Report WHOI 86-16, Coastal Research Center 86-2, Woods Hole Oceanographic Institution, Woods Hole, MA.

Farrington, J.W. et al. 1986. Technical Report WHOI 86-8, Coastal Research Center 86-1. Woods Hole Oceanographic Institution, Woods Hole, MA.

These publications have been obtained.

A considerable amount of New Bedford Harbor data collected by Dr. Farrington's group have been entered in the tape produced by Metcalf and Eddy/Engineers for EPA (discussed elsewhere in this section). Bruce Tripp indicated that the summary data table includes all this information. Late in 1985, representatives from the litigation branch of EPA copied all of John Farrington's raw data notebooks in preparation for the court case surrounding the New Bedford Harbor PCB contamination problem. These data are available on microfiche, but are not accompanied by any interpretation. We do not believe that these data are worth retrieving in that form.

Because the data generated by Dr. Farrington's group will be useful in characterizing toxic substances in organisms and sediment in the Bay, they are definitely a high priority. Both the summary table and the publications are currently available to EPA.

DISCUSSION AND RECOMMENDATIONS

During the first phase of this project, 116 persons were contacted to help identify and obtain data sets that are relevant to lobster landings, water quality and nutrients, and toxic substances in organisms and sediments. A total of 58 data sets were identified. The only data set available for lobster landings was provided by the Massachusetts Division of Marine Fisheries. A total of 28 data sets were identified for water quality and nutrients; four were considered high priority according to the criteria used. Of twenty-nine data sets identified for toxic substances in organisms and sediments, ten were classified as high priority.

The high priority data sets are discussed in the main body of the text and the low priority data sets are summarized in Appendix III. The reader is referred to the Buzzards Bay Information Sheets in Appendix IV for further details on the information obtained or on contracts that did not result in identification of relevant data sets.

In some cases, data sets were not pursued or obtained because our telephone contacts indicated that the effort would not produce fruitful results. Because time and budgetary limitations made it impossible to identify and retrieve every data set generated in the topic areas, emphasis was placed on obtaining data from major studies identified through the telephone process.

Throughout the course of the project, we encountered most of the problems typically associated with collection of historical data. In some cases, data had been lost; in others, they had been discarded. Several contacts indicated that they disposed of data either because an associated publication had been released or because the data were on tapes or disks on a computer system no longer in use. Several people agreed to provide materials to the project, but never followed through, even though they were contacted several times. In some of these cases, we knew the identified data sets were low priority and, therefore, did not make reminder calls.

We have indicated in our discussions of the data sets whether or not the requested data have been received. In cases of unique or particularly useful information, we included data sets even if all the material was not yet currently available.

Several patterns emerged during the application of the screening criteria to the data sets. Most data sets were screened out of the high priority group because the data simply were not available and, therefore, could not be evaluated. Material was unavailable for a variety of reasons: a few sets of data were being kept confidential until a court case was settled or because the funding organization considered them to be proprietary; in many cases, data were lost, misplaced, discarded, or so disorganized that the contact did not have time to pull them together; some data sets would have been difficult to use because they were disorganized, untabulated, or lacking sufficient documentation.

Another major reason for elimination of data sets from the high priority group was lack of sufficient temporal and/or spatial coverage in Buzzards Bay. Unfortunately, characterization of Buzzards Bay has not been the primary purpose of most of the research conducted in the Bay, especially for the three topics discussed in this report. Thus, it is not surprising that no long-term data sets exist that comprehensively characterize Buzzards Bay. Rosenfeld's one-year hydrographic study provided the only comprehensive spatial coverage of the Bay.

Very few studies included formalized quality assurance/quality control programs. The most extensive quality control measures were applied to chemical analyses of toxic substances and were specified in reports documenting the data sets. Most of the data sets cannot be documented reliably because they are reported with insufficient detail to trace and defend what was done. While controls for chemical analyses are often reported, the numbers and results of control samples are not presented in most cases. Because of the frequent absence of QA/QC programs in the data sets reviewed, this screening criterion was rarely met in the evaluation of data sets. The data sets eliminated by this filter were often retrieved at the end of the screening process because they provided data not otherwise available.

The data sets included a wide variety of project designs and techniques for sampling and laboratory analyses. In some cases, data sets are simply data collection exercises, in other cases, methods used reflected the state of the art at the time of project initiation or completion. Some data sets were included in the high priority category because they were of particular interest or value even though problems with the project design were noted.

Discussions of high priority data sets include documentation of the content of each set, evaluation of the set based on the screening criteria, presentation of preliminary formatting information, and summarization of the information. Whether or not a data set is included in the database management system of the Bays Program will ultimately be decided by the Buzzards Bay Technical Advisory Committee (TAC). After reviewing this report, the TAC may decide that some low priority data sets should be considered high priorities and vice versa. As the Buzzards Bay Project proceeds, some low priority data sets may assume greater importance and be reclassified as high priorities.

Although a great deal of information exists in the three topics, the data form a patchy network of information rather than as an integrated body of knowledge that is well-designed, well-organized, readily available and interpretable, and spatially and temporarily comprehensive. One of the purposes of the Buzzards Bay Project is to characterize the health of the estuary and identify trends in that health. The data currently available provide for the beginning of that characterization but are not adequate to detect trends generally. In the future, EPA and the associated advisory committees should plan a program of new research that contributes to the characterization of the Bay. Such a program must identify information priorities and design research that will provide spatial and temporal continuity in important subject areas. This has not been done.

As the Buzzards Bay Program proceeds, opportunities will arise for cooperation between federal and state agencies. The Bays Program provides an opportunity to coordinate Buzzards Bay data correction efforts. Many state agencies are often insufficiently staffed and funded to adequately document, organize, report, and store data for future use; many state agencies lack computerized databases. EPA could augment state efforts to computerize the Buzzards Bay data. For example, the coliform bacteria data discussed in the Water Quality Section have been generated by numerous sources including the U.S. Food and Drug Administration, the Massachusetts Department of Environmental Quality Engineering, and local boards of health. These data now exist as many disjointed and disorganized data sets. Compilation and computerization of the data would provide centralized access to useful information on an environmental aspect of importance within Buzzards Bay. EPA could provide valuable assistance to local, state, and federal agencies by coordinating the consolidation of these data sets. Such an activity would make better and more comprehensive data available to all concerned agencies.

When funding future research, EPA should require its contractors (1) to employ formal quality assurance/quality control plans to provide full documentation of data collection and methods and (2) to enter data into a computerized database for data transfer to the EPA database.

EPA or the TAC can also work cooperatively with other state and federal agencies that fund research in Buzzards Bay to ensure that these data are also incorporated into the Buzzards Bay data set. Interagency cooperation should be initiated to require all investigators to formalize QA/QC procedures and to computerize their data. These requirements along with EPA access to the data for entry into the database management system would help maintain a centralized database for Buzzards Bay. EPA should also inform other agencies of the management goals of the Buzzards Bay project.

We recommend two ways in which EPA or the TAC can encourage investigators to participate in development of a database management system for Buzzards Bay. First, we suggest that EPA or the TAC send a letter to investigators having data sets encouraging these scientists to make their data more accessible and to explain the use of these data in terms of public needs. Secondly, investigators contributing data to the database management system should have the opportunity to review their data during and immediately after it is input into the system and the right to make alterations, if necessary.

The information generated in the current phase of this project will be used in the next phase to summarize published literature reports on the three topics. One purpose of this summary will be identify existing data gaps for Buzzards Bay. While some problems have been identified in this phase of the work, our recommendations in the second phase will be more technical and extensive. Ultimately, however, the decision regarding data gaps depends upon the policy and management goals of the Buzzards Bay Project.

ACKNOWLEDGEMENTS

This portion of the historical data collection could not have been completed without the assistance and cooperation of many people. We appreciate the help of everyone who contributed information and/or data sets (see Appendix II). Several persons merit specific mention. Dr. Wendy Wiltse, Mr. Bruce Tripp, and Mr. Richard McGrath provided useful advice throughout the

project. Ms. Heidi Benz, Ms. Nancy Kelly, Ms. Judy Scanlon, and Ms. Ellen Rosen participated in the identification and collection of data sets in numerous ways. Ms. Ann Loftus, Ms. Betty Lou Sinnott, Ms. Debbie Kohl, Ms. Marcia Desreuisseau, and Ms. JoAnn Mark all helped with typing the report.

APPENDIX I. BUZZARDS BAY INFORMATION SHEET AND GUIDELINES FOR BUZZARDS BAY INFORMATION SHEET

BUZZARDS BAY INFORMATION SHEET

Interviewer:
Date:

1. Citation Number:
2. Program Title:
3. Cognizant Individual:
4. Address:
5. Phone(s):
6. Performing Organization:
7. Address:
8. Phone(s):
9. Funding Organization:
10. Address:
11. Phone(s):
12. Study Topic:
    - On-going research
    - Lobster Landings
    - Toxic substances in organisms and sediments
    - Water quality and nutrient data
    - Other:

    Code:
13. Study Subtopic:
    Code:
14. Comments on the Study:
15. Program Start Date:
16. Program End Date:
17. Other Date Information:
18. Level of Effort:
    Amount:
    Code:
19. Program Duration:
    Code:
20. Form of Data:
    Code:
21. Data Location:
22. Data Availability:
    Code:
23. Data Restrictions:
    Code:
24. Region of Buzzards Bay Covered:
25. Purpose of Program:
    Code:
26. Program Description:
    A. Sampling Frequency
       Code:
    B. Quality Assurance/Quality Control
       Code:
    C. Pollutant Source
       Code:

D. Parameters Measured

1 Physical Oceanography
1 Water Quality
Specifics (0 = Unspecified, 1 = at surface, 2 = at bottom)

0 1 2 Temperature
0 1 2 Salinity/Conductivity
0 1 2 Dissolved Oxygen
0 1 2 pH
0 1 2 Suspended Solids
0 1 2 Nutrients
0 1 2 Biological Oxygen Demand
0 1 2 Turbidity
0 1 2 Alkalinity
0 1 2 Chlorophyll
0 1 2 Other:

1 Sediment Characteristics

Grain Size Distribution
Mineral Composition
Percent Organic Matter
Sedimentation Rate
Other:

1 Chemistry
Specifics (0 = unspecified, 1 = in water column, 2 = in sediment, 3 = in biota; if a "3" is used, the "Biology" section below must be completed.)

0 1 2 3 Petroleum Hydrocarbons
0 1 2 3 PAHs
0 1 2 3 PCBs
0 1 2 3 Pesticides
0 1 2 3 Lead
0 1 2 3 Mercury
0 1 2 3 Cadmium
0 1 2 3 Chromium
0 1 2 3 Other metals
0 1 2 3 Other:

1 Biology

Specifics (0 = unspecified, other; 1 = body burden;
2 = bioaccumulation; 3 = bioassay)

0	1	2	3	Microorganisms/Pathogens
0	1	2	3	Phytoplankton/Microphytes
0	1	2	3	Macrophytes
0	1	2	3	Zooplankton
0	1	2	3	Benthos
0	1	2	3	Nekton
0	1	2	3	Birds
0	1	2	3	Reptiles/Mammals
0	1	2	3	Parasites
0	1	2	3	Other:

Other factors relevant to the program description (e.g., sampling design, replication, sampling techniques, data reports)

27. General Comments:

GUIDELINES FOR BUZZARDS BAY INFORMATION SHEET

ITEM 12: STUDY TOPIC

0 On-going Research
1 Lobster Landings
2 Toxic Substances in Organisms and Sediments
3 Water Quality and Nutrients
4 Other

ITEM 13: STUDY SUBTOPIC

0 None
1 Hydrocarbons
2 PCBs
3 Metals
4 Pesticides
5 Other Toxic Substances
6 Water Quality
7 Nutrients
8 Water Quality and Nutrients

ITEM 18: LEVEL OF EFFORT

0 Information Unavailable
1 < $50,000 per Annum
2 $50,000 to $100,000 per Annum
3 $100,000 to $500,000 per Annum
4 $500,000 to $1,000,000 per Annum
5 > $1,000,000 per Annum

ITEM 19: PROGRAM DURATION

0 Terminated
1 On-going, < 1 Year Anticipated
2 On-going, 2 Year Anticipated
3 On-going, 3 Year Anticipated
4 On-going, > 3 Year Anticipated

ITEM 20: FORM OF DATA

0 Unknown
1 Handwritten or Hardcopy Only
2 Punched Cards
3 Diskette (5-1/4" or 8" Floppy)
4 Portable Magnetic Disk
5 System-dependent Magnetic Tape
6 System-independent Magnetic Tape, Non-standard File Type
7 System-independent Magnetic Tape, NODC File Type
8 Unspecified Magnetic Tape

ITEM 22: DATA AVAILABILITY

0 Data Not Available or Availability Unknown
1 Program Complete, Data Available With Conditions To Be Met
2 Program Complete, Data Available
3 Program On-going, Data Available at Specific Intervals

ITEM 23: DATA RESTRICTIONS

0 Data Restricted
1 Data Not Restricted

ITEM 25: PURPOSE OF PROGRAM

0 Basic Research
1 NPDES or Equivalent Monitoring
2 Permitting and Licensing
3 Baseline Data Collection
4 Agency Mandate
5 Other

ITEM 26: PROGRAM DESCRIPTION

A. Sampling Frequency

1 Weekly
2 Biweekly
3 Monthly
4 Quarterly
5 Annually
6 Irregularly

B. Quality Assurance/Quality Control

1 Formal, Written Program
2 Specific but Unwritten Procedures
3 No Specific Program

C. Pollutant Source

0 Unspecified, Not Applicable
1 Power Generation
2 Mineral Exploration
3 Municipal Discharge
4 Industrial Discharge
5 Dredge Spoil Disposal
6 Oil Spill
7 Other

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APPENDIX III. LOW PRIORITY DATA SETS BY TOPIC AREA

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This appendix presents data sets identified during the project, but not considered high priority. Each data set is described briefly and results of the screening process are discussed. Further information on these data sets is located on the Buzzards Bay Information Sheets in Appendix IV. For a discussion of screening criteria used to rank data, see the main body of the text of this report.

LOBSTER LANDINGS

There were no low priority data sets on lobster landings; the only one was presented in the section on high priority data sets.

WATER QUALITY AND NUTRIENTS

Background Turbidity Conditions of Rhode Island Sound and Buzzards Bay

Mr. Sheldon D. Pratt
Graduate School of Oceanography
University of Rhode Island
Narragansett, R.I.

This study was conducted for the New England Division, U.S. Army Corps of Engineers to collect baseline information for use in assessing the impacts of dredge spoil disposal on turbidity. Water quality data collected included turbidity (percent transmission), temperature, carbon, and nitrogen. Sixteen stations throughout the main part of the Bay were sampled during one cruise in October of 1973. Turbidity profiles are presented in the following report:

> Pratt, S.D. and R.M. Heavers. 1975. Background Turbidity Conditions of Rhode Island Sound and Buzzards Bay. Report prepared for the New England Division, U.S. Army Corps of Engineers, Waltham, MA.

No temperature, carbon, or nitrogen data are included in the report. A formal quality control program is reported. The raw data exist in original analog traces and could be retrieved by Mr. Pratt, with some difficulty, should EPA request them.

Because of the limited temporal coverage, the few water quality parameters measured, and the relative inaccessibility of all the raw data, this data set has been considered of low priority.

Water Quality Data from Northeast Monitoring Program, Ocean Pulse Program, and Other NOAA Programs

Mr. Jay O'Reilly
National Marine Fisheries Service
National Oceanographic and Atmospheric Administration
U.S. Department of Commerce
Sandy Hook, NJ

NOAA collects water quality data in surface and bottom waters in conjunction with various NOAA programs designed to monitor the health of U.S. waters. Parameters measured include temperature, salinity, dissolved oxygen, nutrients, and chlorophyll. Sampling is conducted irregularly, mainly at stations located at 41°29'N, 70°53'W, southeast of Wilkes Ledge. Specific, but unwritten, QA/QC procedures are followed.

The data, available in hard copy and on magnetic tape, have been received. Because the data set could not be fully evaluated and covered a limited area spatially, it has been classified as low priority.

Marine Monitoring Assessment and Prediction (MARMAP)

Dr. Wallace Smith
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
Sandy Hook, NJ

The MARMAP program began in 1977 and is ongoing. No stations are located in Buzzards Bay, although there are stations outside the mouth of the Bay. The data include measurements of temperature, salinity, dissolved oxygen, nutrients, biological oxygen demand, turbidity, and chlorophyll. Phytoplankton and zooplankton are also sampled. Cruises are conducted at least six times per year. The data set was eliminated because the coverage did not include stations inside Buzzards Bay.

Hydrography of the Slocum River Estuary

Dr. James G. Hoff
Southeastern Massachusetts University
North Dartmouth, MA

Dr. Hoff conducted a two-year study of five stations located in the Slocum River Estuary. Temperature, salinity, dissolved oxygen, and nutrients were measured on a monthly basis. The results of the study have been published in the following paper:

> Hoff, J.G., P. Barrow, and D.A. McGill. 1969. Some aspects of the hydrography of a relatively unpolluted estuary in southeastern Massachusetts. Proceedings of the 24th Purdue Industrial Waste Conference, Part I, 87-98.

The data are not available except as averages and ranges presented in the paper. The data set was screened out due to unavailability of the original data. The paper depicts seasonal data points for temperature, salinity, dissolved oxygen, phosphates, nitrates, N-P ratio and percent oxygen saturation at all stations.

This hydrography study is associated with a companion study on fish distribution. That work is reported in:

Hoff, J.G. and R.M. Ibara. 1977. Factors affecting the seasonal abundance, composition and diversity of fishes in a southeastern New England estuary. Coastal Mar. Sci. 5: 665-675.

The Anadromous Fish Dynamics Program

Mr. Phillips Brady
Division of Marine Fisheries
Mass. Department of Fisheries, Wildlife, and Recreational Vehicles
East Sandwich, MA

In 1984, the Division of Marine Fisheries began collecting water quality data in streams used by anadromous fish. Streams flowing into Buzzards Bay that have been included in the program to date are the Paskamansett and Mattapoisett Rivers. Data collected include surface and bottom water temperature, pH, salinity, dissolved oxygen, nutrients, turbidity, alkalinity, transparency (color), and sulfates. Data on pesticides in water and fish, lead in fish, and aluminum in the sediments are also collected as deemed necessary by DMF staff.

While the data are available to EPA, they are not readily accessible and it would require considerable effort to collect the data from the various field sheets on which they are recorded.

Because of the limited spatial coverage of this data set and the difficulty involved in accessing it, the data set was determined to be of low priority.

Engineering Feasibility Study of Dredging and Disposal of Highly Contaminated Sediments from the Acushnet River Estuary

Mr. Alan Randal
U.S. Army Corps of Engineers
Waltham, MA

This data set is currently being collected and only the most preliminary data are available. Water quality data include only temperature and salinity measurements. This data set is not included as a high priority data set because spatial coverage of the study is limited to the Acushnet River Estuary and the data are unavailable at this time. The data will be given to EPA via the Superfund office once the study has been completed.

Acid Rain Monitoring Project

Dr. Paul Godfrey
Water Resource Research Center
University of Massachusetts
Amherst, MA

This ongoing study began in 1983 with the purpose of measuring pH, alkalinity, nutrients, and numerous metals in fresh water. During the first two years of the study, all of the lakes and streams in Massachusetts were sampled. Approximately 650 sites were then identified as long-term monitoring

sites and were sampled (once per water body) during the third year. Samples were taken from each of the streams feeding into Buzzards Bay. Dr. Godfrey indicated that with some searching this data could be located. The data set was considered low priority because the streams sampled do not belong to the main body of the estuary and the data were not readily available.

Movement of Pesticide Residue in Water from Cranberry Bogs

Dr. Karl H. Deubert
Cranberry Experiment Station
University of Mass. Agricultural Experiment Station
Wareham, MA

Dr. Deubert collected data on temperature, salinity, dissolved oxygen, and turbidity in water in a cranberry bog in Carver, MA. The data were intended to provide baseline data for an in-depth study on how to reduce export of pesticides out of cranberry bogs and were collected as part of several research programs over a period of twelve years. They exist in handwritten form only and would not be easily retrievable. Because the data set is extremely limited in terms of spatial coverage and the data are not readily accessible, this set was determined to be of low priority.

Effects of Electrical Power Generation on Marine Fisheries of the Cape Cod Canal and Approaches

Mr. Steve Collings
Division of Marine Fisheries
Mass. Department of Fisheries, Wildlife, and Recreational Vehicles

The Division of Marine Fisheries, several other state and federal agencies, and the Canal Electric Company conducted studies in 1971 and 1981 to assess the effects of power generation on marine resources of the Cape Cod Canal.

The objectives of the 1971 study were to obtain baseline hydrographic and biological data and to monitor any impacts of plant operation on the sport fishery. The 1981 study was designed to determine seasonal distribution and abundance of ichthyoplankton and lobster larvae in the Canal and the northeast portion of Buzzards Bay and to assess any effects of power generation on finfish, lobster larvae, and ichthyoplankton.

Weekly temperature (^{o}F) data were collected at the eastern and western entrances to the Canal from 1966 through 1969. Salinities (ppt) was measured monthly at high and low tides in the Canal. These data are presented as means and ranges in the following report:

> Fairbanks, R.B., W.S. Collings, and W.T. Sides. 1971. An Assessment of the Effects of Electrical Power Generation on Marine Resources in the Cape Cod Canal. Division of Marine Resources, Massachusetts Department of Natural Resources, Boston, MA.

The 1981 report includes average monthly surface and bottom water temperatures (^{o}C) and salinities (ppt) for northern Buzzards Bay and the Cape Cod Canal from 1976 through 1979. The data are presented in the following report:

> Collings, W.S., C. Cooper-Sheehan, S.C. Hughes, and J.L. Buckley. 1981. The Effects of Power Generation on Some of the Living Marine Resources of the Cape Cod Canal and Approaches. Division of Marine Fisheries, Massachusetts. Department of Fisheries, Wildlife, and Recreational Vehicles, Boston, MA.

Because of extremely restricted spatial coverage and the limited number of relevant parameters measured, this data set was judged to be of low priority.

Disposal Area Monitoring and Observation System (DAMOS)

Mr. Steven Congdon
Regulatory Section
U.S. Army Corps of Engineers
Waltham, MA

This is an ongoing program designed to monitor the fate and effects of dredge disposal material at specified dump sites, one of which is located at Cleveland Ledge outside the west end of the Cape Cod Canal.

Water quality data have been collected by the DAMOS program since 1977, including temperature, salinity, suspended solids, and turbidity. In addition, sediments are tested for chemical oxygen demand, petroleum hydrocarbons, PCBs, pesticides, and a number of metals. Tissue analysis of mussels is conducted in cooperation with the Mussel Watch Program. Since the Cleveland Ledge site is rarely used, only hydrographic data are available for this disposal site.

Although the data are stored in a computer database system, they are available only in hard copy reports to agencies and individuals outside the Corps of Engineers.

The extremely restricted spatial coverage, limited number of parameters measured, and inaccessibility of the computerized database rendered this data set of low priority for the purposes of the Buzzards Bay Project.

Massachusetts Coastal and Commercial Lobster Trap Sampling Program

Mr. Bruce T. Estrella
Division of Marine Fisheries
Mass. Department of Fisheries, Wildlife, and Environmental Law Enforcement
Sandwich, MA

This is an ongoing program designed to assess the general health and abundance of the coastal lobster resource and variation in population parameters due to fishing effort, regulatory changes, or environmental factors. Catch per unit effort and biological data (including size frequency,

sex, and condition, i.e., molt stage, culls and other shell damage, external gross pathology, mortality, and presence of extruded ova on females) are collected temporally and areally for annual stock assessments. This time series began in 1981.

The only water quality data collected in conjunction with the program is continuous water temperature monitoring with programmable electronic analog thermisters which are housed on bottom moorings. One was located near Cleveland Lighthouse in November, 1985 and at three different depth strata in Cape Cod Bay in January, 1988. Temperatures are recorded at two-hour intervals and monitors are retrieved by SCUBA every 6 months and offloaded. At present, Buzzards Bay temperature data is available for the period November, 1985 - February, 1988.

This data set is important because it provides the only continuous temperature data of which we are aware. Because of its effect on the onset and peak time of lobster molting as well as molt probability and subsequent landings, this data set should be reclassified as high priority when the temperature data are available.

Salt Marsh Nutrient Cycling

Dr. Ivan Valiela
Boston University Marine Program
Woods Hole, MA and
Dr. John Teal
Woods Hole Oceanographic Institution
Woods Hole, MA

Drs. Valiela and Teal have worked for many years in the Sippewissett Marsh in West Falmouth, MA, studying nutrient cycling in the marsh under a variety of conditions. The list of publications documenting their work may be found in the Buzzards Bay Bibliography compiled by Mr. Bruce Tripp. Drs. Valiela and Teal have conducted their research in collaboration with many colleagues and students. The data sets resultant from their work would be extremely difficult to retrieve because they are located in a number of different places. Considerable effort would be required to document the data sets such that they could be used by someone other than the original investigators. For this reason, the data sets have not been listed as high priority sets.

Historical Changes in Eelgrass Populations in Buzzards Bay

Mr. Joseph Costa
Boston University Marine Program
Marine Biological Laboratory
Woods Hole, MA

EPA funded this project to document historical changes in eelgrass populations in Buttermilk Bay and to investigate the effects of disturbances, such as hurricanes and nutrient loading on eelgrass. Because high nutrient levels are suspected of affecting eelgrass populations, Mr. Costa has collected nutrient data for Buttermilk Bay. Details of the study may be obtained from the Buzzards Bay Project final report.

Because of the limited number of water quality parameters being sampled, and the fact that the data will be available to EPA as a matter of course, this data set was determined to be of low priority. This is the only effort to map eelgrass beds (from aerial photos) on a bay-wide basis.

Oil Spill Restoration Program

Mr. Arnie Carr
Division of Marine Fisheries
Mass. Department of Fisheries, Wildlife, and Recreational Vehicles
East Sandwich, MA

Data on temperature, salinity, dissolved oxygen, pH, nutrients, chlorophyll and petroleum hydrocarbons in sediment and shellfish were collected in the early 1970s by DMF as part of a program to monitor the effects of an oil spill on shellfish. The area from West Falmouth Harbor to Red Brook Harbor in Bourne was sampled.

These data were never published. They were requested, but could not be located by Mr. Carr. The data may be on file with DMF's Shellfish Branch in East Sandwich, but we have been unable to reach Mr. Michael Hickey to confirm this. Because of the inaccessibility of the data, and also because of limited spatial coverage, this data set has been classified as low priority.

Shellfish Technical Assistance

Mr. Michael Hickey
Division of Marine Fisheries
Mass. Department of Fisheries, Wildlife, and Recreational Vehicles

This is an ongoing program initiated in 1965 by DEQE to assess water quality for the purpose of managing shellfish resources. Water quality data (temperature, salinity, dissolved oxygen, and pH) are collected irregularly in waters adjacent to all towns bordering Buzzards Bay.

The data are available in hard copy only and are filed in several places: local boards of health, DMF's East Sandwich office, and DEQE's Southeast Regional Office in Lakeville. They have been requested but not received. For this reason it was not possible to evaluate the data set and it has, therefore, been classified as low priority.

Other Low Priority Water Quality and Nutrients Data Sets

One data set discussed under the Toxic Substances Section of this appendix include data on water quality:

Mass Balance and Flux of PCBs in Upper New Bedford Harbor	Dr. Royal Nadeau

Other data sets discussed under the Toxic Substances Section of High Priority Data Sets that include water quality data:

PCBs in Buzzards Bay: Effects on Energetics and Reproductive Cycles of Bivalve Molluscs	Dr. Judy Capuzzo
Modeling of the Transport, Distribution, and Fate of PCBs and Heavy Metals in the Acushnet River/New Bedford Harbor/Buzzards Bay System	Mr. Richard A. McGrath

TOXIC SUBSTANCES IN ORGANISMS AND SEDIMENTS

Dredging Permit Application Program	Mr. James Bajeck U.S. Army Corps of Engineers Waltham, MA

Mr. Bajeck is reponsible for the dredging permit application program or the U.S. Army Corps of Engineers (ACOE). All of the available permit applications for dredging in Buzzards Bay have been obtained from Mr. Bajeck. Most of the data are limited in content because little testing has been required by the ACOE for dredging permits in most parts of the Bay. The ACOE determines what parameters need to be measured for a permit application. In many cases, the ACOE is aware of the condition of sediments in a particular area and only requires testing of sediments if contamination is suspected. Therefore, there is considerable inconsistency in the parameters that are measured and reported by permit applicants and data are reported inconsistently. The methods used in testing are not indicated and no quality control or quality assurance is provided. Station locations are identified by points on maps, rarely by latitudes and longitudes.

The permit applications are not considered high priority data sets because: 1) there is inconsistency among the applications in terms of format and parameters measured, 2) methods are not clearly indicated, 3) the raw data are difficult to use, and 4) no quality assurance or quality control procedures are identified. Further, temporal coverage at any one permit site is limited to one-time sampling.

Distribution of Toxic Dinoflagellate Gonyaulax tamarensis in the Southern New England Region

Dr. Donald Anderson
Biology Department
Woods Hole Oceanographic Institution
Woods Hole, MA

Dr. Anderson is conducting a study to provide baseline population data on the distribution of the dinoflagellate Gonyaulax tamarensis in relation to its southerly and northerly distribution, against which future spreading of the species can be assessed. The southern limit has been determined to be Great South Bay, Long Island. Approximately 30 to 35 sites in Buzzards Bay were sampled from 1979 to 1980; however, the Buzzards Bay component of the study was terminated after the first year of study. The results of this study are available in the following publication:

> Anderson, D.M., Kulis, J.A. Orphanos, and A.R. Ceurvels. 1982. Distribution of the toxic dinoflagellate Gonyaulax tamarensis in the Southern New England region. Est. Coast. Shelf Sci. 14:447-458.

This data set was eliminated because paralytic shellfish poisoning is not now considered a serious problem within Buzzards Bay and, therefore, the study is not of immediate relevance to the Buzzards Bay Project. The data are available from Dr. Anderson should they be deemed to be of particular use in the future.

Pesticides from Cranberry Bogs

Mr. Lawrence W. Gil
Division of Water Pollution Control
Mass. Dept. of Environmental Quality Engineering, Westborough, MA

The Massachusetts Department of Environmental Quality Engineering is currently conducting a study of outflows from cranberry bogs draining into Buttermilk Bay. This project, which has just begun, will monitor nutrients, pesticides, and herbicides from the bogs. Sampling will be conducted during the summer of 1986 and outflows will be monitored during a wet weather event and under dry weather conditions. The data set is so far from completion that it could not be evaluated; therefore, it was considered of low priority.

Biological Effects of the Bouchard No. 65 Oil Spill in Buzzards Bay, Massachusetts, January, 1977

Dr. Bruce Peterson
and Dr. John Hobbie
Ecosystems Center
Marine Biological Laboratory
Woods Hole, MA

The Frederick E. Bouchard No. 65 ran aground on Cleveland Ledge on January 28, 1977, and 81,146 gallons of No. 2 fuel oil were spilled. In February 1977, Drs. Bruce Peterson and John Hobbie began research to study the biological effects of the Bouchard spill. They produced the following report:

> The Ecosystems Center. 1980. Biological Effects of the Bouchard No. 65 oil spill in Buzzards Bay, Massachusetts, January 1977. Report supported in part by

Contract No. 03-7-022-35133 from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, and in part by the Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA. 39 pp. plus 4 appendices.

In February and March of 1977, 72 stations were sampled to measure the distribution of oil residues and any biotic effects of the spilled oil. Subgroups of samples from these stations were analyzed for petroleum hydrocarbons, chlorophyll concentrations, numbers of individuals and species of benthic invertebrates, numbers of bacteria, and sediment texture.

From this preliminary work, two sites were chosen for intensive study: 1) Phinney's Harbor Oil Study Site downcurrent from the spilled oil and 2) Northwest Gutter Control Site near Naushon Island of the Elizabeth Islands. Three stations were established at each site based on bottom type.

Between April 20 and October 4, 1977, one of the six stations was sampled per week. Two replicate sets of nine van Veen grabs (1/25 m^2) were sampled. One set was used for analysis of benthic invertebrates. The other set was used to measure petroleum hydrocarbons, chlorophyll and other plant pigments, sediment organic content and grain size, bacterial numbers, and bacteria hydrocarbon and glucose metabolism. A separate set of cores was sampled for benthic respiration.

The raw data were recorded on a PDP11 computer at the Ecosystems Center in Woods Hole, MA. When the computer was discontinued, the computer tapes were discarded. Therefore, the only available data for this study are in the report mentioned above. The data set is considered low priority because the data are not available.

Long-term Effects of the West Falmouth Oil Spill: Follow-up Study

Dr. Allan Michael
9 Main Street
Peabody, MA

Dr. Michael conducted a two year follow-up study on the response of benthic communities to the 1969 FLORIDA oil spill near West Falmouth, MA. The methods used and analyses conducted were nearly identical to those used by Sanders, Grassle, and Hampson in their 1969-1972 study of the West Falmouth oil spill (see high priority data sets for information on the first study). The results of Dr. Michael's study are published in:

Michael, A.D., C. Van Raalte, and L.S. Brown. 1975. Long-term effects of an oil spill at West Falmouth, Massachusetts. In: 1975 Conference on Prevention and Control of Oil Pollution, American Petroleum Institute, Washington, D.C., pp. 573-582.

Dr. Michael has provided summary data sheets for the benthic communities that indicate the total number of occurrences of each species and total number of individuals of each species for the entire sampling period. Dr. Michael has been unable to locate the complete data set that accompanies the publication. The data set was determined to be a low priority set due to lack of available data.

Genetic Variability of Capitella capitata in Relation to the West Falmouth Oil Spill

Dr. Judith Grassle
Marine Biological Laboratory
Woods Hole, MA

Dr. Grassle conducted a study to determine the degree of genetic variability in the several species of Capitella and the relationship of this variability to dosages of oil from the West Falmouth oil spill. Her work involved using vertical starch gel electrophoresis to study protein polymorphism at two malate dehydrogenase loci in animals collected from Wild Harbor and nearby West Falmouth waters immediately after the West Falmouth oil spill. Her results are published in:

Grassle, J.F. and J.P. Grassle. 1974. Opportunistic life histories and genetic systems in marine benthic polychaetes. J. Mar. Res. 32(2): 253-284.

Grassle, J.P. and J.F. Grassle. 1976. Sibling species in the marine pollution indicator Capitella, (Polychaeta). Science 192: 567-569.

Grassle, J.F. and J.P. Grassle. 1977. Temporal adaptations in sibling species of Capitalla, pp. 177-189. In: B.C. Coull (ed.), Ecology of Marine Benthos. Belle W. Baruch Library in Marine Science. Vol. 6, Univ. of South Carolina Press, Columbia, SC.

The data do not directly measure toxic substances in organisms and for this reason do not fit neatly any of the topic areas under study. The data from this study are available, but it would involve a considerable commitment of time on the part of Dr. Grassle to retrieve the data. Because the data would be difficult to obtain, the data set was screened from the high priority data sets although this is one of very few data sets which begin to demonstrate effects of contamination on marine species.

Northeast Monitoring Program

Mr. Robert Reid
National Oceanic and
Atmospheric Administration
Sandy Hook, NJ

The Northeast Monitoring Program (NEMP) was started in 1979 to detect long-term trends in habitat quality along the continental shelf of the northeastern United States. One station, located in Buzzards Bay and designated "Station 36" by NOAA, is equivalent to "Station R" designated by Howard Sanders. The station is located approximately west of the Woods Hole Channel and southeast of Wilkes Ledge in the center of the Bay. Sediment samples have been collected once or twice a year at Station 36 as part of the NEMP. Samples have been analyzed for the following:

Benthic macrofauna
Grain size distribution
Percent total organic carbon
Percent nitrogen
Polynuclear aromatic hydrocarbons

Polychlorinated biphenyls
Metals (cadmium, chromium, copper, lead, mercury, nickel, zinc)

Dr. Reid has sent some information on the PAHs and PCBs that he had for the station. Station locations for the data were provided, however, methods were not included in the data provided. Therefore, the data set has been considered a low priority because of poor documentation although this information may be available.

Influence of Environmental Contaminants on Cytchrome P-450 Mixed-Function Oxygenases in Organisms

Dr. John Stegeman
Woods Hole Oceanographic Institution
Woods Hole, MA

Dr. Stegeman, his colleagues, and his students have worked on inducible enzymes, specifically P-450 oxygenases, and their relationship to environmental contaminants. The biochemical techniques that are used have utility in assessing the condition of marine organisms in relation to contaminants. Several of his publications document studies using species from Buzzards Bay:

1. Stegeman, J. 1978. Influence of environmental contamination of cytochrome P-450 mixed-function oxgenases in fish: implications for recovery in the Wild Harbor marsh. Can. J. Fish. Res. Bd. 35(5): 668-674.

2. Stegeman, J.J., J.W. Gooch, E. Harris, J. Mayernik, C.S. Giam, and P.J. Kloepper-Sams. PCB distribution and induction of cytochrome P-450E in the marine fish scup (Stenotomus chrysops). In preparation.

3. Stegeman, J.J., A.V. Klotz, B.R. Woodin, and A.M. Pajor. 1981. Induction of hepatic cytochrome P-450 in fish and the indication of environmental induction in scup (Stenotomus chrysops). Aquatic Tox.1: 197-212

Studies of this type require special techniques and considerable expertise for interpretation of the biochemical and physiological meaning of the results. Most of the data generated by these studies is not yet available. These data are important because they show a clear biological change in Buzzards Bay species that can be linked to contaminants.

These data were not considered high priority data because they are unavailable at this time.

Mass Balance and Flux of PCBs in Upper New Bedford Harbor

Dr. Royal Nadeau
Environmental Response Team
U.S. Environmental Protection Agency
Edison, NJ

Dr. Nadeau conducted a short-term study with the Coast Guard to determine the mass balance and flux of PCBs in the water column in the New Bedford

Harbor Estuary at the Coggleshall Street Bridge. This study was conducted by continuously sampling the water column over a 48-hour period. Samples were taken at five-foot depth intervals. Temperature, salinity, current velocity and direction, and PCBs in the aqueous and particulate phases of seawater were measured. Plankton tows were also conducted to determine levels of PCBs in the filtrate from the tows. The filtrate included all particulate matter, not just plankton. A small synoptic survey of the water one meter below the surface was taken from Route I-195 north to the Aerovox Company in the Harbor.

These data were not considered a high priority because 1) they are largely unavailable and are tied up in the enforcement and litigation groups in EPA, 2) spatial coverage is very limited, 3) most of the study measures PCBs in the water column, a topic not relevant to this study, and 4) the few data on PCBs in organisms (i.e., plankton) are really measures of both plankton and detritus, thus not giving a clear picture of PCBs in plankton alone.

Body Burdens of PCBs in Winter Flounder and Lobster

Mr. Richard A. McGrath
Battelle Ocean Sciences
Duxbury, MA

This project was conducted as part of the New Bedford Harbor Program to evaluate body burdens of four PCB homologues in edible tissues of winter flounder and lobster in three size classes from four areas in the Acushnet River Estuary, New Bedford Harbor, and adjacent areas of Buzzards Bay. By comparing these data with data for whole body burdens on the same specimens developed for the modeling program, it is possible to calculate edible tissue/whole body ratios for these contaminants.

Although limited in scope (only 36 individual specimens were analyzed), this study provides information that is usually lacking in historical records of PCB contamination in Buzzards Bay biota and is also readily available electronically. Because it is also part of the Superfund RI/FS at New Bedford, it should be considered to be of the same priority as the larger study.

PCBs in Striped Bass in Buzzards Bay

Dr. Robert Griffith and
Mr. Thomas Rusek
Southeastern Mass. University
North Dartmouth, MA

Dr. Griffith is supervising this research project being conducted by his student, Tom Rusek. The purpose of the study is to determine if isomers of PCBs in striped bass can be used to determine the origin of the bass stock. The project was initiated in November 1985, and, therefore, the methods have not been fully established. Collection stations in Buzzards Bay are expected to be located from New Bedford Harbor to Gooseberry Point.

It is premature to include this project at this early stage.

The Relationship of PCBs and Sediment Surface Area

Dr. Jacek Sulanowski
Dept. of Earth Sciences
Bridgewater State University
Bridgewater, MA

Dr. Sulanowski has worked for several years in collaboration with Dr. John Farrington (Woods Hole Oceanographic Institution) studying PCBs in New Bedford Harbor. Dr. Sulanowski provided the following data to the program: 1) a summary of sediment PCB data for the Acushnet River and New Bedford Harbor that is a composite of his unpublished data and of published and unpublished data collected by John Farrington, b) a map of station locations for the data, c) a summary of particle size and CHN analyses for twelve stations that Dr. Sulanowski has analyzed, and d) estimates of PCB load in the sediments and calculations of effects of dredging. No methods were provided; however, they should be readily obtainable if information in this data set is needed later for characterization of the Bay.

This data set was considered a low priority because relatively little new information was provided on toxic substances (only three data points available for Dr. Sulanowski's data). The particle size, particle settling time, and CHN data are informative and can serve a useful purpose in providing correlative data important to interpretation of PCB data. Little documentation of methods was provided.

Levels of PCBs in Lobster Larvae in New Bedford Harbor

Dr. Fred Thurberg
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
Milford, CT

Dr. Thurberg began a study of levels of PCBs in lobster larvae in New Bedford Harbor in May 1984 that is anticipated to run for three years. Sampling is conducted annually in New Bedford Harbor. At the present time, the data are unavailable because they are being held up by litigation proceedings. Dr. Thurberg has indicated that the data set will most likely be available after the court case has been decided.

The data set has been determined to be low priority because the data are unavailable and, therefore, can not be evaluated.

PCB Residues in Mercenaria mercenaria from New Bedford Harbor

Dr. Karl H. Deubert
Cranberry Experimental Station
University of Mass. Agricultural Experiment Station
Wareham, MA

This program was undertaken to determine PCB levels in quahogs (*Mercenaria mercenaria*) from outer New Bedford Harbor two years after discharges of PCBs in plant effluents were halted. Depuration of PCBs under field conditions was studied to determine the rate of decline of residue levels over a one year period in contaminated quahogs transplanted to clean areas.

Data on PCB levels in quahogs collected in 1976 and 1978 are available as means in the following publication:

> Deubert, K.H., P. Rule, and I. Corte-Real. 1981. PCB residues in Mercenaria mercenaria from New Bedford Harbor, 1978, Bull. Environ. Contam. Toxicol. 27:683-688.

Depuration rates of PCBs over a one-year period are also reported.

Because the raw data are unavailable and could not be fully evaluated, this data set was considered low priority.

Fine-grained Sediment and Industrial Waste Distribution and Dispersal in New Bedford Harbor and Western Buzzards Bay, MA

Colin P. Summerhayes
Woods Hole Oceanographic Institution
Woods Hole, MA

According to Dr. John Milliman at the Woods Hole Oceanographic Institution, Colin Summerhayes and his colleagues published the following report in 1977 and in the more recent overview paper:

> Summerhayes, C.P., J.P. Ellis, P. Stoffers, S.T. Briggs, and M.G. Fitzgerald. 1977. Fine-grained sediment and industrial waste distribution and dispersal in New Bedford Harbor and Western Buzzards Bay, Massachusetts. WHOI Tech. Rept. WHOI-76-115, 110 pp.
>
> Summerhayes, C.P., J.P. Ellis and P. Stoffers. 1985. Estuaries as sinks for sediment and industrial waste--a case history from the Massachusetts coast. In: Contributions to Sedimentology, Ch. 14 (ed. H. Fuchthauer, A. Lisitzyn, J. Milliman and E. Siebold). Stuttgart.

This two-year study was designed to establish and explain the past and present patterns of movement and accumulation of fine-grained sediment, human waste, and industrial waste in New Bedford Harbor and its approaches. This interdisciplinary research has produced a valuable body of information on the relationships of sediments and metals. Dr. Summerhayes is in England and has part of the raw data. Other parts of the data are in Arabia with J. Ellis and Germany with P. Stoffers. The data set is considered of low priority only because the raw data is not available. See the Buzzards Bay Information Sheet for Dr. John Milliman for information on this data set. Much discussion of the data can be found in the publications.

Use of the Green Seaweed Ulva as a Monitor of Pollution in Coastal Waters

Dr. Robert Wilce
University of Massachusetts
Amherst, Massachusetts and
Dr. Howard Levine
State University of New York
Stony Brook, New York 11794

Over 100 collections of Ulva lactuca were made in 1979 to determine the level of PCBs and metals in this seaweed. Approximately 10 stations were

located in Buzzards Bay. Much of the data are available in Dr. Levine's Ph.D. dissertation, completed while he was attending the University of Massachusetts:

> Levine, H.G. The green seaweed Ulva as a monitor for pollution in coastal waters. Ph.D. Dissertation, University of Massachusetts. Available through University Microfilms International, 300 North Zeeb Road, Ann Arbor, MI 48106 for $39.

A subsequent publication covers portions of the work:

> Levine, H.G. and R.T. Wilce. 1980 Ulva lactuca as a bioindicator of coastal water quality. Water Resources Research Center, University of Massachusetts at Amherst, Publ. No. 119, 83 pp.

Neither the dissertation nor the publication are complete, as Dr. Levine has much of the raw data. Dr. Levine indicated that he would send the raw data not contained in either publication, but the materials have not been received to date. Dr. Levine has indicated in follow-up calls that he will send the information when he has time. Stations were located in Slocums River, New Bedford Harbor, Weweantic River, and Westport River. Data on temperature, salinity, and pH are also available for these stations. The data set did not pass the screening process as high priority data set due to the difficulty in obtaining the data from Dr. Levine. However, when that material becomes available, this data may become a high priority data set.

Life Table Analyses of Two Species of Capitella from New Bedford Harbor, MA

Dr. Judith Grassle
Marine Biological Laboratory
Woods Hole, MA

Dr. Judy Grassle conducted a life-history analysis of two species of Capitella as part of a larger study of toxic pollutants in sediments and organisms in New Bedford Harbor, MA. In establishing life tables, she ran experiments under three conditions: 1) clean sediments, 2) sediments with PCBs added, and 3) inner New Bedford Harbor sediments. Capitella species were collected from New Bedford Harbor. Two temperatures were used for the experiments, at the end of which the following were measured: number of eggs per brood, mortality rates, time to maturity, viability, and number of broods. Dr. John Farrington of the Woods Hole Oceanographic Institution conducted the PCB body burden analyses.

Dr. Grassle indicated that her data are available in a report that she would send when it is complete. Dr. John Farrington has the PCB data. Because the data are not presently available to the project staff, the data set cannot be evaluated and, therefore, is classified as low priority.

PCBs in Sediment of New Bedford Harbor

Mr. Richard Packard
Southeast Regional Office
Mass. Dept. of Environmental Quality Engineering
Lakeville, MA

In May 1978 and August 1979, the DEQE took sediment cores inside New Bedford Harbor and analyzed them for PCB levels. The data are in handwritten form only and are not well-tabulated. Apparently this data set is part of the data we anticipate receiving from the DEQE in Lakeville. Until it is received, the data set cannot be evaluated and, therefore, is considered low priority.

Influence of Colloidal Organic Matter on the Distribution of PCBs

Dr. Bruce Brownawell
Oregon State University
Corvallis, OR

Mr. Brownawell is currently completing his doctoral dissertation on the influence of colloidal organic matter on the distribution and partitioning of PCBs in marine sediments. His stations have been located in three places: inner and outer New Bedford Harbor and in the main axis of Buzzards Bay. Mr. Brownwell indicated that the best source of his data will be his dissertation when it is complete. Currently he has gas capillary chromatograms that include peak areas, but not concentrations of PCBs. The remaining data are on graph paper and in laboratory notebooks. There are two papers available on Mr. Brownawell's work that he has made available to the project:

Brownawell, B.J. and J.W. Farrington. 1985. Chapter 7. Partitioning of PCBs in marine sediments. In: Marine and Estuarine Geochemistry, A.C. Sigleo and A. Hattori, Eds. Lewis Publishers, Inc., Chelsea, MI, pp. 97-120.

Brownawell, B.J. and J.W. Farrington. 1986. Biogeochemistry of PCBs in interstitial waters of a coastal marine sediment. Geochimica et Cosmochimica Acta 50: 157-169.

Brownawell, B.J., Ph.D. 1986. Dissertation, WHOI/MIT Joint Program in Oceanography (WHOI 86-19), Woods Hole, MA.

The data in Dr. Brownawells thesis has only recently become available and was not evaluated for this report. The data set should probably be re-classified as high priority in any subsequent review.

Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic

Mr. Frank Steimle
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
Sandy Hook, NJ

Samples of the ocean quahog were collected during the summers of 1981 and 1982 from many stations on the continental shelf along the northwestern Atlantic. One station was located in Buzzards Bay. Organic substances analyzed included polychlorinated biphenyls, polynuclear aromatic hydrocarbons, and petroleum hydrocarbons. Metals analyzed included cadmium, chromium, copper, lead, nickel, silver, and zinc. A publication reporting the results of this study is published in a Fishery Bulletin article by F.W. Steimle, P.D. Boehm, V.S. Zdanowicz, and R.A. Burno. This data set has been eliminated as a high priority data set because of low spatial coverage in Buzzards Bay. Dr. Paul Boehm has provided his report on the organic component of the study. Dr. Zdanowicz indicated that he would send his data, but they have not been received.

PCBs and Mercury in Shellfish in the New Bedford Harbor Area

Mr. Michael Hickey
Division of Marine Fisheries
Mass. Department of Fisheries, Wildlife, and Recreational Vehicles
East Sandwich, MA

Mr. Hickey works with the Department of Environmental Quality Engineering in obtaining data on PCBs and mercury in shellfish meats. He has loose pieces of data sheets from a number of years that have not been synthesized into a readily useable form. The data are available, but they are in a condition too disorganized and too poorly documented to be of much use. With some effort, it may be possible to obtain the data from DEQE files in Lakeville.

Uptake and Mobilization of Heavy Metals in a Salt Marsh

Dr. Anne E. Giblin
Ecosystems Center
Marine Biological Laboratory
Woods Hole, MA

Dr. Anne Giblin has conducted basic research to determine which metals are biologically available to organisms and which are retained by salt marsh sediments. In particular, she determined the effects of heavy metals on plant production rates, bioaccumulation rates, and body burden levels in salt marsh organisms. She also studied bacterial oxygen uptake to ascertain bacterial resistance to heavy metals. Dr. Giblin's work was conducted at Sippewisset Marsh in West Falmouth, MA as part of an ongoing program to ascertain the effects of sewage sludge and nutrient additions on salt marshes. Her program was conducted over a four year period from 1976 to 1980. The data are located in a number of places: as hard copy, on computer cards, and on PDP11 computer tapes. Dr. Giblin indicated that the best sources of the data are her publications and dissertation. The publication is the best source of pore water data because the constants used to calculate them have been revised since the dissertation was published.

This data set has been determined to be a low priority set because the raw data are located in several places and cannot be readily retrieved. If and when the original data are ever pulled together, correction of some of the calculations using revised constants would be required. Calculations of pore water equilibria in the thesis were done using stability constants which are now out of date.

Trace Metal Analyses of Sediments and Organisms

Mr. Vincent Zdanowicz
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
Sandy Hook, NJ

Mr. Zdanowicz is a chemist who specializes in research on heavy metals. He works collaboratively at the National Marine Fisheries Service (NMFS) laboratory in Sandy Hook, NJ, on a number of different projects. He has data sets related to three projects of interest to the Buzzards Bay program. The first project was discussed earlier in this section (Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic).

The second project for which data exist is the Northeast Monitoring Program, one station of which was located in Buzzards Bay. There are limited data for this station and the data set is considered of low priority because of the limited spatial coverage in Buzzards Bay.

The third project, which is on-going, is the National Status and Trends Benthic Surveillance Project. The project includes research units on water quality, development of a database, mussel watch, and analyses of organic substances and metals in different marine areas throughout the United States. Mr. Zdanowicz is responsible for the metals analyses at approximately 15 to 18 sampling stations throughout the Northeast, one of which is in Buzzards Bay. The program began in 1984 and sampling will be conducted at these stations for at least three consecutive years to establish baseline data. The data are on magnetic tape on the Gray VAX computer located at the Woods Hole Oceanographic Institution, but accessible through the investigators at NMFS in Sandy Hook, NJ. The data from this program are not available at this time, but will be included in the annual report produced in the spring of 1986.

The data set for the National Status and Trends Benthic Surveillance Project has limited coverage in Buzzards Bay and is currently unavailable. Therefore, it has been eliminated as a high priority data set. A reassessment of the utility of this data set to the Buzzards Bay Program at a later date may result in the inclusion of this data set in the EPA database management system.

Other Low Priority Toxic Substances

Several data sets discussed under the Water Quality and Nutrients Section of this appendix include data on toxic substances in sediments and/or organisms:

Engineering Feasibility Study of Dredging and Disposal of Highly Contaminated Sediments from the Acushnet River Estuary	Mr. Alan Randal
Salt Narsh Nutrient Cycling	Dr. Ivan Valiela and Dr. John Teal
Coliform Bacteria in Buzzards Bay	Ms. Tina Davies
The Anadromous Fish Dynamics Program	Mr. Phillips Brady
Oil Spill Restoration Program	Mr. Arnie Carr
PCBs in Buzzards Bay: Effects on Energetics and Reproductive Cycles of Bivalve Molluscs	Dr. Judy Capuzzo
Movement of Pesticide Residue in Water from Cranberry Bogs	Dr. Karl H. Deubert

Other data sets discussed under the Water Quality and Nutrients Section of High Priority Data Sets that include toxics data are:

Water Quality and Wastewater Discharge Data	Mr. Lawrence W. Gil
City of New Bedford Section 301(h) Applications for Modification of Secondary Treatment Requirements for Discharges into Marine Waters, 1979 and 1983	Camp Dresser and McKee, Inc.
Site Selection and Study of Ecological Effects of Disposal of Dredged Materials in Buzzards Bay, MA	Dr. Thomas Gilbert and Dr. Al Barker (see Coliform Data Summary)